Bulletin

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ASTM BULLETIN

Published by
AMERICAN SOCIETY for
TESTING MATERIALS

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AUGUST—1945

No. 135

THEY TOO SERVE

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FACED with the loss to the Armed Forces of one out of three of its skilled lamp shop craftsmen, Corning Glass Works turned to women workers. Old-timers were outspokenly skeptical. "Gals" were strictly counter to glass blowing tradition.

Never-the-less, nimble feminine fingers quickly proved their worth. Today Corning's lamp shops are decidedly coeducational. Women perform not only the simpler operations, but frequently tackle more complicated glass fabrication. Thus experienced craftsmen can be assigned to more intricate glass making tasks.

By using women to replace workers called to the Armed Forces, by operating three shifts and by adding lamp shop facilities at Parkersburg, West Virginia, Corning has made considerable progress toward meeting production demands.

You may find, however, that there are times when your laboratory supply dealer may be out of even standard catalog items of Pyrex, Vycor and Corning Glassware. And as for special apparatus, that is most difficult of all. Be assured, though, that this situation is only temporary and when VICTORY comes, both Corning and dealers will be in a better position than ever to serve you.

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"Promotion of Knowledge of Materials of Engineering, and Standardization of Specifications and Methods of Testing"

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R. E. Hess, Editor
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CABLE ADDRESS—TESTING

Number 135 August 1945

Annual Meeting Acts on Standards, By-laws

Committee on Standards Approves Many New Tentatives; New York District Sponsors Dinner with President's Address and Rear Admiral Combs

While the Forty-eighth Annual Meeting of the Society was held as a one-session business meeting on Wednesday, June 27, in the Hotel Pennsylvania in New York City, thus permitting important actions on formal standards and on the By-laws to be taken and enabling formal announcement of the election of new officers, other matters which would have taken place at a normal Annual Meeting were carried through by holding on this same day in the morning a meeting of the Committee on Standards which took action to approve many new tentatives. With the cooperation of the New York District Committee a very interesting and successful local meeting was held in the evening at which retiring President P. H. Bates gave his Annual Address and Rear Admiral Lewis B. Combs presented a guest address dealing with the work of the Sea-Bees and the Navy Civil Engineering Corps.

Announcement of the change in the usual type of Annual Meeting had been given in Circular No. 263 dated May 1 and this was followed on May 25 by Letter Circular to Members No. 264 which covered the amendments of the By-laws and the revisions of the charter. Intensive study by the Executive Committee and also by the Special Study Committee resulted in proposed amendments of the By-laws which the Annual Meeting approved for submission to Society letter ballot; this ballot is being distributed to the members and will be canvassed sometime in early September. A comparison of the present By-laws with those proposed, as set forth in the letter circular, will show that the changes are intended to accomplish the following principal purposes: A more suitable classification of members, broader qualifications for honorary membership, elimination of the provision for membership in perpetuity, substitution of a Board of Directors for an Executive Committee as the governing body of the Society, change in title of Secretary-Treasurer to Executive Secretary and substitution of the collective noun "Tentatives" for "Tentative Standards."

In order to effect the changes in the By-laws concerning the Board of Directors it is necessary to revise the Society's charter and to do this the Annual Meeting approved a resolution authorizing the necessary actions for an amended charter. The letter ballot vote on the proposed resolution showed overwhelming affirmative returns as announced at the meeting, more than 1900 ballots being received.

Actions on Standards

From the accompanying summary of actions taken at the Annual Meeting and at the meeting of Committee E-10 on Standards, it will be apparent that the Society's work involving the development of standard specifications and tests continues intensively. Perhaps the most significant item is that involving the action on new tentatives which is an indication of new work during the preceding months. The total accepted as shown in the table and others scheduled for action by Committee E-10 during the late summer compare favorably with the past few years.

Some notes on a number of the actions involving standards and tentatives appear on the following pages—the material being segregated according to the committees responsible. All of the items, of course, are not detailed or even mentioned. For the most part the reports of the standing committees as preprinted, give more detailed information. Also these actions will be noted in the *Summary of Proceedings* which is mailed usually simultaneously with this Bulletin for the members' information in connection with the letter ballot on adoption of tentatives as standard and also action on revisions of standards.

At the Annual Meeting various reports were received by the session with, in most cases, actions requested being approved.

President's Address; New Officers

The Annual Address of the retiring President, P. H. Bates, entitled "Preparing for the Future of A.S.T.M.," is published in full elsewhere in this Bulletin and each member is urged to review it. During his term of office, Mr. Bates has

Executive Committee Report

An ample number of copies of the 1945 Annual Report of the Executive Committee were struck off to provide for widespread distribution among Society members. A copy will be forwarded on request to any member. The report is a most important one of interest to every member of the Society.

taken a very intensive interest in many of the studies being carried on involving publications, Society administration, and other items, some of which are covered in the proposed By-law revisions. It was quite appropriate, therefore, that he should speak on the indicated subject.

The new officers whose nominations were announced in the previous BULLETIN and in a Letter Circular were declared elected by the session on the basis of the letter ballot returns. Biographical material on these men follows in this BULLETIN.

A short news account of the meeting of the New York District where the new officers of the Society were introduced is presented later. Also an extended synopsis of the talk, by Rear Admiral Lewis B. Combs, is given.

New York District Host to Society

FOLLOWING the A.S.T.M. Annual Meeting on June 27, the New York District Committee sponsored a dinner and technical session at which President P. H. Bates presented his annual address and the guest speaker, Rear Admiral Lewis B. Combs, Assistant Chief, Bureau of Yards and Docks, gave a most interesting address on "Preparing the Way for Victory with the SeaBees." President Bates' address is printed in full in this BULLETIN and there is an extended abstract of the talk by Admiral Combs.

Arrangements for the dinner and session were carried through by the New York District officers, Myron Parke Davis, Otis Elevator Co., Chairman, and G. O. Hiers, National Lead Co., Secretary. Mr. Hiers had charge of the dinner which was attended by upwards of 240 members and guests, including officers of the New York Section of the American Society of Civil Engineers and the Society of Naval Architects and Marine Engineers whose metropolitan membership had received notices of the meeting. Other guests included officials of the Third Naval District and the Brooklyn Navy Yard. In the dinner audience were many Navy officials, quite a few of whom had been associated with Admiral Combs.

Following a word of greeting from Mr. Davis, the toastmaster and technical chairman, Dr. R. J. Moore, Bakelite Corp., took over and introduced those at the speakers' table including the newly elected Vice-President, T. A. Boyd, General Motors Research Laboratories, and also the senior Vice-President, Arthur W. Carpenter, The B. F. Goodrich Co. Each vice-president responded appropriately. The new President, J. R. Townsend, Bell Telephone Laboratories, Inc., was not present because of a European trip.

Following the two principal addresses the audience was treated to the first formal showing of the Navy film depicting the construction and operation of the Navy's huge floating dry docks; also a supplementary film "To the Shores of Iwo Jima." The films were of added interest to those present because a guest who accompanied Admiral Combs from Washington, Lieutenant C. M. Warren, took most of the sequences concerning the dry docks and also contributed to the battle films.

There were upwards of 350 present at the technical session following the dinner.

The Society is indebted to the New York District for arranging this meeting which dovetailed so nicely with the annual meeting.

Many New Tentatives Accepted—Revisions Also Approved

IN ORDER that recommendations from numerous standing committees with respect to the publication of proposed specifications and tests could be approved, the Society's Committee E-10 on Standards took over some of the usual annual meeting functions and at a special all-morning meeting on June 27 reviewed a great many recommendations dealing with new tentatives and revisions of existing tentatives. While almost 60 proposed new specifications and tests were covered in the reports of the standing committees, and 56 revisions of tentatives, a number of these actions were withheld by the respective groups because of incomplete ballot returns or last-minute changes or negative votes. Many of the items withheld will be submitted to the Committee on Standards at its proposed August meeting.

E-10 PERSONNEL

At its meeting, the Standards Committee elected N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric Corp., as

SUMMARY OF ACTIONS TAKEN BY COMMITTEE E-10 ON STANDARDS AND AT ANNUAL MEETING AFFECTING STANDARDS AND TENTATIVE STANDARDS.

	Existing Tentative Standards Adopted as Standard	Standards in Which Revisions Will Be Adopted	New Tentative Standards	Proposed Revisions of Existing Standards Accepted as Tentative	Existing Tentative Standards Revised	Standards and Tentative Standards Withdrawn	Present Total Standards Adopted	Present Total Tentative Standards
A. Ferrous Metals—Steel, Cast Iron, Wrought Iron, Alloys, etc.	0	1	0	0	0	0	156	45
B. Non-Ferrous Metals—Copper, Zinc, Lead, Aluminum, Alloys, etc.	10	19	6	0	27	2	73	96
C. Cement, Lime, Gypsum, Concrete, and Clay Products	5	5	1	1	3	0	136	39
D. Paints, Petroleum Products, Paper, Textiles, Rubber, Soap, etc.	20	16	33	2	13	0	447	259
E. Miscellaneous Subjects, Testing, etc.	9	1	0	0	0	0	29	22
Total	44	42	39	3	43	2	841	461

New President
J. R. Townsend

the chairman, succeeding Past-President H. S. Vassar, whose term expired. Messrs. J. L. Miner, Vice-President, The Atlas Lumnite Cement Co., and J. H. Foote, Supervising Engineer, The Commonwealth & Southern Corp., have been appointed members for the regular term of three years succeeding Mr. Vassar and F. E. Richart. Other members whose terms hold over include R. D. Bonney, Congoleum-Nairn, Inc.; F. H. Jackson, Public Roads Administration, Federal Works Agency; and L. B. Jones, The Pennsylvania Railroad Co. As has been frequently pointed out, Committee E-10 on Standards is a most important group, acting for the Society in the interval between annual meetings with respect to new standards or revisions of tentative standards and standards, and judging whether a consensus has been reached by the various standing committees.

Committee Actions

Some notes on the recommendations received from the various standing committees and for the most part detailed in the preprinted reports follow. Reference should be made to an article in the back portion of this Bulletin listing the complete titles of new tentatives with their assigned serial designations, see page 55.

Committee B-1 on Copper and Copper Alloy Wires:

Four existing tentative specifications covering certain types of copper conductors, one giving requirements for lead-coated soft copper wire, were revised, and revisions in standards proposed for immediate adoption were accepted by the Society's Annual Meeting, these applying to other types of electrical conductors covered by Committee B-1 standards.

Committee B-5 on Copper and Copper Alloys, Cast and Wrought:

As frequently is the case, in view of its large number of specifications for various types of cast and wrought copper and copper products, Committee B-5 had many proposals, including five new tentatives, four of which cover beryllium copper in various forms: strip, rod and bar, and wire. These are to replace and amplify existing Specifications B 120. Eighteen tentative standards were revised, many of these applying to castings, and others covering bus bars and pipe, sheet and strip and plate, etc., produced from the various alloys in the committee's field of work. Several of the revisions pertain to tolerances for straightness, thickness, length, etc., and in the rod and bar specifications, revised tension and bend test requirements have been approved. Some of the changes pertain to chemical composition. All changes were detailed in the preprinted B-5 report.

In addition to the beryllium specifications B 120, the specifications for phosphor tin, B 51, were also withdrawn.

Committee B-7 on Light Metals and Alloys, Cast and Wrought:

Two types of alloys are specified in the new tentative requirements for magnesium-base alloy permanent mold castings. These commercial castings have a specific gravity not exceeding 1.9. The revisions in five other magnesium product specifications—sand castings, sheet forgings, material in ingot form, and bars, rods and shapes—will bring the requirements in line with latest commercial practice and with corresponding Government specifications. Numerous new alloys are being included and quite a number are being deleted in respective items. Full details are given in the current report. This report also includes a discussion by Junius D. Edwards covering "A Comparison of the Performance of Anodic Coatings Exposed to Salt Spray and to the Weather."

Committee C-5 on Fire Tests:

Although the subcommittee in charge had developed certain revisions in the Tentative Method of Test for Fire-Retardant Properties of Wood (C 160) which uses a modified crib test, it was decided to continue the tentative without change so that more data might be developed from further use of the method and at the same time opportunity would be provided to perfect sampling requirements.

Committee C-7 on Lime:

Of the four actions submitted by the lime committee, three involved portions of the Methods of Physical Testing of Quicklime and Hydrated Lime (C 110). The change in Section 6 covering standard consistency determination is primarily editorial in character, but the other items, a new test for popping and pitting, and the addition of a method for water retention, were considered of much importance. The popping and pitting test is considered essential in the specifications for special finishing hydrated lime, and in the revisions of normal hydrated lime (C 6), and though some members voted negatively, favoring the previously used autoclave method, there was an overwhelming vote in favor of the proposals. The water retention test is important in connection with the specifications for hydrated lime for masonry purposes.

Another action was proposed affecting the Standard Methods of Chemical Analysis of Limestone, Quicklime, and Hydrated Lime (C 25) where a new method for computing unhydrated oxides will be issued for study and use prior to actual incorporation. Details of all of these changes were given in the Committee C-7 report.

Committee C-14 on Glass and Glass Products:

While there was only one recommendation from the Committee on Glass, it involves an interesting and important problem, namely, the definition of the term "glass." From its present form as published in the Book of Standards, the definition will now read, following action by the Standards Committee as follows:

Glass.—Glass is an inorganic product of fusion which has cooled to a rigid condition without crystallizing.

(*a*) Glass is typically hard and brittle, and has a conchoidal fracture. It may be colorless or colored and transparent to opaque. Masses or bodies of glass may be made colored, translucent, or

New Vice-President
T. A. Boyd

opaque by the presence of dissolved, amorphous, or crystalline material.

(*b*) When a specific kind of glass is indicated, such descriptive terms as flint glass, barium glass, window glass, etc., should be used following the basic definition, but the qualifying term is to be used as understood by trade custom.

(*c*) Objects made of glass are loosely and popularly referred to as glass; such as glass for a tumbler, a barometer, a window, a magnifier, or a mirror.

Committee C-16 on Thermal Insulating Materials:

The revision of the Tentative Specification for Mineral Wool Thermal Insulating Cement (C 195) involves a reduction in the requirement for thermal conductivity at 200 F. from 0.80 to read 0.70 max. Btu. in per sq. ft. per hr. In the section covering thermal conductivity test, a provision will be added that the oven chamber is to be adequately vented. Six emergency specifications covering various types of thermal insulation, blanket, preformed pipe covering and structural insulating board, ES 14 to ES 19, inclusive, were withdrawn.

Committee D-2 on Petroleum Products and Lubricants:

The new methods of analyzing petroleum sulfonates cover procedures for determining mineral oil, sodium sulfonate, carboxylate soap, inorganic salt, free alkali content, combining weight, and specific gravity of crude and refined petroleum sulfonates. It is also applicable, with modification, to potassium and ammonium sulfonates. The method is accepted substantially as it was published for information last year.

The revision in the test for color by means of the Union Colorimeter, D 155, deleted the requirement that the metal plate bearing a license number be affixed to the instrument, because the patent on this instrument has expired.

In an emergency provision involving the standard test for burning quality of kerosine oils, D 187, permission is given as an emergency proposition to substitute a Plume and Atwood burner in case a Miller burner cannot be obtained.

Committee D-5 on Coal and Coke:

Based on considerable study a tentative revision of Methods of Laboratory Sampling and Analysis of Coal and Coke (D 271) will be published for a year which will ultimately provide different requirements than now incorporated in the maximum permissible differences between two or more determinations of volatile matter.

Committee D-6 on Paper and Paper Products:

In its work on methods of test, Committee D-6 has been studying new methods and has also been giving critical study to the various procedures established by other agencies, including the Technical Association of the Pulp and Paper Industry. Seven methods were accepted by the Standards Committee, covering ply adhesion, absorption of water and writing ink, wet curl, vapor permeability, edge tearing strength, and wet tensile breaking strength. Adding these methods to the large number already issued, the committee now has an imposing list of tentative specifications and tests in its charge. Five previously issued tests will be referred to letter ballot for adoption as standard.

Committee D-9 on Electrical Insulating Materials:

Of the several recommendations approved coming from Committee D-9 one, a new test for the gas content of insulating oils, had been published as information in 1944. Oils for which this test are applicable would be used in capacitors, and paper-insulated, lead-covered electric cables of the oil-filled type. The determination of gas content is desirable for any insulating oil intended for use in a degassed state. Two methods are covered: a routine method, and a referee method for use when a test of high accuracy is desired.

The revisions of tentative methods were accepted covering molded materials, D 48, which is issued in a complete new form but using references to other test procedures. As revised, these methods represent a complete directory of tests applicable to the types of materials covered. One of the revisions involves a standardized conditioning treatment, details of which are given in the preprinted report. The tentative revision in the standard for testing insulating oils, D 117, is partly editorial, but there is a new description of the dielectric test strength procedure and details are given concerning test cells and their care.

Committee D-11 on Rubber and Rubber-Like Materials:

The three actions here involve new tentatives—one a method for identifying and for analysis for synthetic elastomers, a recommended practice for conditioning of rubber and plastic materials for low-temperature testing, and a specification for natural rubber cups for use in hydraulic actuating cylinders. The methods for synthetic elastomers are very urgently needed. The new specifications for natural rubber cups were prepared by Technical Committee A on Automotive Rubber to meet an urgent request from the Army Ordnance Department and the automotive manufacturers. Importance of these cups is indicated by the fact that natural rubber was permitted long after synthetics were required for other products. While synthetic cups are being developed and specifications may soon be completed for them, there will be still the need for these new specifications.

The recommended conditioning practice covers the general theory underlying all low-temperature testing, the characteristic behavior of natural rubber, synthetic rubber, rubber-like materials and plastics, and the conditioning procedures necessary in making low-temperature tests. It has been developed by a joint section of Subcommittee XXV on Low-Temperature Tests with representatives of Committee D-20 on Plastics.

Committee D-16 on Industrial Aromatic Hydrocarbons:

The acceptance of 19 new tentatives developed by Committee D-16 represents a record as far as the number of new recommendations is concerned. This committee, organized about two years ago has, through its subcommittees, been studying intensively various requirements involving both specifications and tests for the various materials in its field, and last year issued proposed methods which were distributed for information and comment. The new tentatives as listed later in this BULLETIN involve seven test methods for refined aromatic products covering distillation, acidity, paraffins, etc. Six specifications pertinent to aromatic chemicals and six on aromatic solvents are all published in the committee report which also includes data on some extensive cooperative distillation tests, and a report on aromatic petroleum solvents.

Committee D-18 on Soils for Engineering Purposes:

A new test for specific gravity of soils has been under consideration for some time and about two years ago several objections were raised to the then proposed procedures. Since then various objections have been considered and revisions made, so that the method as issued should be of widespread service.

Committee D-20 on Plastics:

Of the six actions approved on the recommendation of Committee D-20, one was a new test for determining ammonia in phenol-formaldehyde molded materials, and five are revisions of existing tentative specifications or methods. Changes in the cellulose acetate plastic sheet specifications, D 786, involve requirements for flammability of material 20 mills in thickness. Methods of Conditioning and Classifying Conditioning of Plastics, D 618, is being simplified in respect to exposure requirements and additional standard temperatures are being added. A molding practice is being extended to include an additional test specimen; additional limits are being added to the cellulose acetate sheet specification; the light source is being more adequately specified in the haze method; and details of the technique of machining the notch are being added to the impact method.

C. H. Rose | W. A. Zinzow | J. R. Freeman, Jr. | L. P. Spalding | L. J. Markwardt

NEW OFFICERS

The recent election of officers, as announced at the annual meeting, resulted in the unanimous election of J. R. Townsend as President, T. A. Boyd as Vice-President, and the following as members of the Executive Committee: J. R. Freeman, Jr., L. J. Markwardt, C. H. Rose, L. P. Spalding, and W. A. Zinzow.

President

J. R. Townsend, the new President, Materials Engineer, Bell Telephone Laboratories, Inc., New York 14, N. Y., was born in Baltimore, Md., and attended Baltimore City College and Brooklyn Polytechnic Institute. After experience with the Bethlehem Steel Co. and the Mathematics and Dynamics Branch of U. S. Army Ordnance in World War I, in 1919 he became a member of the Technical Staff of the Western Electric Co., and from 1925 through to 1944 he was Materials Standards Engineer of the Bell Telephone Laboratories, Inc., becoming Materials Engineer in 1945.

He is the author of numerous technical papers and reports. In 1930 he was awarded (jointly with W. A. Straw and C. H. Davis) the A.S.T.M. Charles B. Dudley Medal for the outstanding paper on "Physical Properties and Methods of Test for Some Sheet Non-Ferrous Metals." In addition to A.S.T.M., he is a member of the American Welding Society and the American Society of Mechanical Engineers. He has served as Consultant for the National Research Council, the War Production Board and other war agencies.

Mr. Townsend has been extremely active in many fields of work of the Society. He has been Chairman of Committee B-6 on Die-Cast Metals and Alloys since 1934, is a Past-Chairman of Committee E-10 on Standards, and is active in the work of other groups, including Committees B-2 on Non-Ferrous Metals and Alloys, A-10 on Iron-Chromium-Nickel and Related Alloys, E-1 on Methods of Testing (Chairman of the Section on Indentation Hardness), and the Research Committee on Fatigue of Metals. Recently he headed a special group which intensively studied the desirability of the Society extending its work to include the field of testing of parts and assemblies, which led to the new Administrative Committee on Simulated Service Testing.

Vice-President

T. A. Boyd, Head, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit 2, Mich., received his Bachelor of Chemical Engineering degree from Ohio State University in 1918. His degree of Ch.E. was received in 1938. Beginning in 1918 he was Research Chemist, Dayton Metal Products Co., and when the Research Division of this organization became a part of the General Motors Corp. in 1920 forming the basis of its central research division Mr. Boyd continued in this work. Since 1923 he has been head of the Fuel Department. His research work has been concentrated chiefly on automobile and aircraft fuels and their efficiency. He was co-discoverer with C. F. Kettering and Thomas Midgley, Jr., of the anti-knock effects of the liquid compounds of lead. Recent work under his direction has aided the development of wartime high-output motor fuels, in particular the high octane aircraft gasoline. The author of a large number of technical papers he has also prepared various popular reports and articles and two books, one on "Gasoline—What Everyone Should Know About It" and the other, "Research—The Pathfinder of Science and Industry."

A member of A.S.T.M. for many years he has served as chairman of one of its largest and most active committees, D-2 on Petroleum Products and Lubricants, since 1932. He serves the Society as a member of its Detroit District Committee. He is a member of a number of technical and professional societies including the following: American Chemical Society, Society of Automotive Engineers, American Petroleum Institute, Engineering Society of Detroit (member, Board of Directors and President, 1943–1944). Other affiliations include: National Advisory Committee for Aeronautics, Chemists' Club (New York), Detroit Boat Club.

Members of Executive Committee

John R. Freeman, Jr., Technical Manager, American Brass Co., Waterbury 88, Conn., a native of Winchester, Mass., is a graduate of the Massachusetts Institute of Technology (S.B. degree in Electro Chemistry, 1916). Following a short service with the General Abrasive Co., he was from 1917 to 1930 with the National Bureau of Standards, Washington, D. C., serving as senior metallurgist and Assistant Chief of the Division of Metallurgy. From 1930 to 1934 on the technical staff of the American Brass Co., he was then appointed Assistant Technical Manager and has been in his present position since 1938.

For many years Mr. Freeman has participated very actively in the work of A.S.T.M. committees responsible for work on specifications and tests and research involving: non-ferrous metals and alloys (Committee B-2); copper and copper base alloys (Committee B-5); corrosion (Committee B-3); the Research Committees on Fatigue of Metals and on Effect of Temperature on the Properties of Metals and several others. A member of A.S.T.M. Committee E-6 on Papers and Publications, he has recently carried out an intensive survey of the A.S.T.M. publication setup. He has written numerous technical contributions, especially involving physical metallurgy. He is a member of the American Institute of Mining and Metallurgical Engineers, and the British Institute of Metals.

L. J. Markwardt, Assistant Director, U. S. Forest Products Laboratory, Madison 5, Wis., was born in Lansing, Iowa, and is a graduate of the University of Wisconsin in Civil Engineering, B.S. degree in 1912 and the C.E. degree in 1922.

He has been in engineering research work at the U. S. Forest Products Laboratory at Madison since 1913. Prior to his appointment as Assistant Director in 1944, Mr. Markwardt was in charge of the Division of Timber Mechanics which has carried on very extensive research on war problems. He has participated in work leading to the use of wood in aircraft and for other war purposes. Mr. Markwardt is the author of numerous bulletins, papers, and articles dealing with the properties and engineering uses of wood—four of his technical bulletins for the Department of Agriculture have involved strength and related properties of wood grown in the United States and Alaska, with one devoted entirely to redwood. His notable A.S.T.M. Edgar Marburg Lecture, 1943, on "Wood as an Engineering Material" has been widely distributed.

He has been a member of A.S.T.M. since 1920 and has been particularly active in the work of Committee D-7 on Wood, of which he is secretary, and he serves as chairman of the Subcommittee on Methods of Testing. He is a member of the Society of American Foresters, Engineering Society of Wisconsin, American Railway Engineering Association, and the National Advisory Committee on Aeronautics. Also, he is a member of the Timber Research Committee of the International Union of Forest Research Organizations.

Carlton H. Rose, Chemist, National Lead Co., Research Laboratories, 105 York St., Brooklyn 1, N. Y., with Colorado his native state, received his Bachelor of Science degree from the University of California in 1924. For eight years he was employed as a chemist by the Pacific Coast Branch, National Lead Co., and since 1932 has been with the Research Laboratory of the company. Specializing in pigments and protective coatings, he has been very active in the work of A.S.T.M. Committee D-1 on Paint, Varnish, Lacquer, and Related Products since 1929, now serving as secretary and participating in numerous subcommittee projects, being chairman of the group on definitions. He is one of the A.S.T.M. members of the Joint Committee with the Federation of Paint and Varnish Production Clubs, is a past-president of the New York Club, and is a member of the American Institute of Chemists and the American Chemical Society. He has written various reports and papers and serves as a reviewer for *Chemical Abstracts*.

L. P. Spalding, Chief Research Engineer, North American Aviation, Inc., Inglewood, Calif., was born in Los Angeles, Calif., and attended schools in Phoenix, Arizona, and received his B.S. degree in Chemistry from the California Institute of Technology in 1936. Following two years as metallurgist, Kinney Iron Works, he became a member of the technical staff of North American Aviation, Inc., concerned with physical, chemical, and metallurgical testing and research in materials, and also with investigations of aircraft parts and accessories. Later he was Assistant Chief Research Engineer, and for the past four years has been in his present position. In addition to supervision of the general testing laboratory and work on processes and control, he directs fundamental work carried out in the research laboratory. Mr. Spalding has been active in A.S.T.M. studies involving the testing of parts and assemblies and has aided in arranging a close liaison between A.S.T.M. technical committees and many of the leading aircraft companies.

William A. Zinzow, Chief Physicist, Bakelite Corp., 230 Grove St., Bloomfield, N. J., received his A.B. degree from Ripon College, Ripon, Wis., in 1915, his birthplace. Mr. Zinzow was for ten years a teacher in high school and university. Then, following a year with the Westinghouse organization, he joined the technical staff of the Bakelite Corp. in June, 1926. An authority in the field of electrical insulating materials and plastics, he has been very active in the work of two of the largest A.S.T.M. Committees, D-9 on Electrical Insulating Materials, and D-20 on Plastics, serving as Secretary of D-9, chairman of the D-20 Subcommittee on Thermal Properties, and participates in many of the subcommittee activities. He has taken an active part in the work of the Society of the Plastics Industry, serving on the S.P.I. Technical Committee and the Thermoplastic Division. Mr. Zinzow has written various technical papers and reports covering different phases of plastics; this has included papers and discussion in each of the two A.S.T.M. symposiums on plastics, 1937 and 1944.

Forty-Year Members

INCLUDING the twelve companies and individuals noted below who in 1945 have been continuously affiliated with the Society for forty years, there have been awarded 81 Forty-Year Certificates.

H. C. Berry
Frank Orville Clements
Engineers' Society of Western Pennsylvania:
  K. R. Treschow
Myron S. Falk
Lawford H. Fry
W. C. Hanna
Marquette Cement Manufacturing Co.:
  D. S. Colbern
Anson Marston
Pittsburgh Testing Laboratory:
  A. R. Ellis
R. H. Harry Stanger
Worcester Polytechnic Inst.:
  F. W. Roys
York Ice Machinery Corp.:
  Frank J. Allen

This year, because of the curtailment of the annual meeting program, the Certificates were mailed with an appropriate letter from the Executive Committee to the various company and personal members. It will be noted from the list that many of the individuals and company representatives have been extremely active in A.S.T.M. work.

Translating Research

RESEARCH becomes of service in the ordinary walks of life only when it can be translated into processes or products which contribute to raising the scale of living, to the improvement of health, to the promotion of industry and agriculture, and to the national defense. The great store of scientific knowledge which has been accumulated in the past through the careful, painstaking investigations of countless scientists becomes of value to society when research points the way to harnessing it to a practical application.

It should be emphasized, however, that the research organization is only part of the team necessary to bring the fruits of scientific work to the service of mankind. It requires the wisdom and courage of management to make the investment, a capable engineering organization to design the plant, an able and experienced production organization to make material of marketable quality and suitable cost, and a sales organization to develop markets. . . .

Since World War I, the chemical industry has made remarkable progress, due in important measure to the friendly attitude of the Government toward research. Granted a continuation of this attitude, organized research will go on creating new products, for what remains to be done is far greater than anything that has been accomplished in the past.

In the words of Pasteur: "Take interest, I implore you, in those sacred dwellings which one designates by the expressive term: Laboratories. Demand that they be multiplied, that they be adorned; these are the temples of the future—temples of well-being and of happiness. There it is that humanity grows greater, stronger, better."

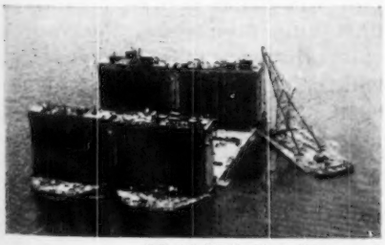
[1] Excerpts from the concluding remarks of Elmer K. Bolton, Chemical Director, E. I. duPont de Nemours and Co., in accepting the Perkin Medal presented to him on January 5 in New York. The medalist is chosen by a committee representing the Society of Chemical Industry, American Chemical Society, Electrochemical Society, American Institute of Chemical Engineers, and the Société de Chimie Industrielle.

Preparing for Victory with the SeaBees[1]

By Rear Admiral Lewis B. Combs (CEC) USN

WAR is no longer and never again will be a contest solely between the armed forces of countries. It is, rather, a test of strength between total nations and the component parts thereof. Heroic courage and aggressive leadership—on land, on the sea, under the sea, and in the air—must be backed up by the best equipment possible, by efficient supporting forces and services, and a highly organized transport system for personnel, mat´riel, and supply. This is a technological war with the engineer and scientist taking a major part in every phase of this supporting effort. Superiority has hinged, to a very marked degree, on new scientific developments and speed in their practical application. It has been necessary to progress from laboratory to mass production in short order.

The engineering problems involved, in every field of engineering, have been many and varied. One outstanding development has been revolutionary applications of electronics. Chemistry's contributions in synthetic rubber, high-octane gas, and new super-explosives are well publicized. The role of the civil engineer, however, has been primarily to apply previously recognized principles and procedures to war projects, on a larger scale, in greater volume, and in shorter time than ever before.



Official U. S. Navy Photograph

Having arrived at an advance base, two sections of an "ABSD"—the Navy's floating dry dock—are brought together and welded into place. When completed, some of these docks will hold our largest battleships. Some of the docks have a capacity of 56,000 to 100,000 tons. In one eight-month period, the docks handled almost 180 ships. They have played a vital role in servicing battle-damaged ships and keeping others at the peak of fighting trim. This development of the Bureau of Yards and Docks is another milestone in Naval warfare.

There are three main branches of military science. Strategy is the planning of warfare; tactics is the execution of strategic plans; logistics is the supplying of everything, personnel as well as matériel, required by the strategic plans and tactics, in the right amount, at the right place, and at the right time. Logistics—more than ever before in history—constitutes one of the major problems of this war. We of the Civil Engineer Corps and the Construction Battalions of the Navy are most closely concerned with this third branch of military science—logistic planning and support—support to the combat forces, both here on the continent as well as in the immediate theaters of operation and combat. Never in any previous war has such great emphasis of the Naval shore establishment been necessary.

The Civil Engineer Corps

Civil Engineers have been functioning for, and with the Navy since 1807; as civilians until 1881 when the Corps started with one Captain and nine other officers. Today the Corps has a strength, regulars and reserves, of approximately 10,600 warrant and commissioned officers, about 70 per cent of whom are serving with the Naval Construction Battalions.

The Bureau of Yards and Docks, the medium through which the Civil Engineer Corps functions, was created as a distinct agency of the Navy Department in 1842. Naval regulations define its scope as follows:

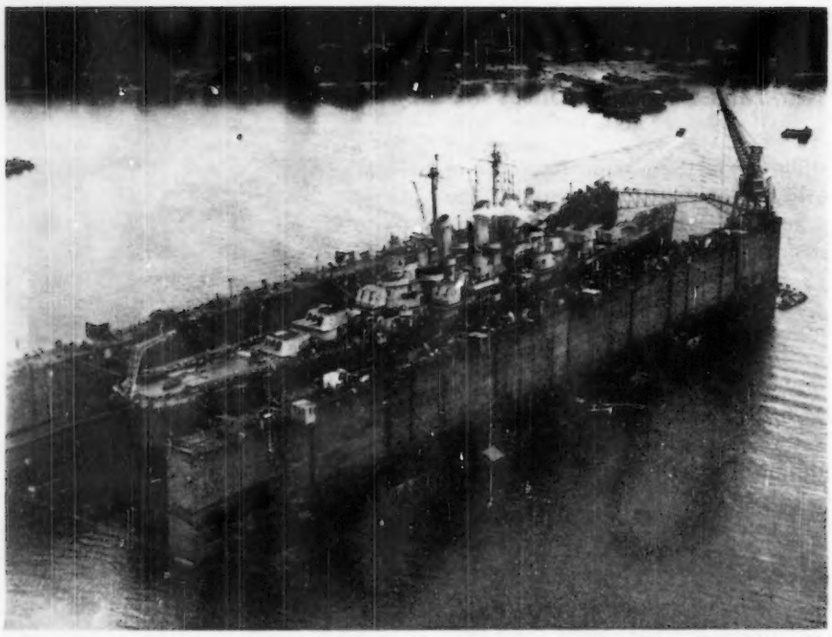
"Under the direction of the Secretary of the Navy, it is charged with, and responsible for, assistance in planning, the design, construction, alteration and inspection of the Public Works and Public Utilities for the Shore Establishments of the Navy, except as otherwise prescribed, their repair and upkeep." Like all good regulations, that paragraph is brief and to the point, but I can assure you that the ramifications covering its application today are voluminous and varied.

[1] An extended abstract of the address presented by Admiral Combs at the dinner meeting on June 27, sponsored by the New York District Committee, following the 1945 A.S.T.M. Annual Meeting.

A native of Vermont, but calling Rensselaer, N. Y., his home, Admiral Combs is a graduate of Rensselaer Polytechnic Institute, Class of 1916, and entered the Navy's Civil Engineer Corps at the beginning of World War I. He took an indoctrination course at the Naval Academy and has served successively in responsible positions at many Navy Yards. He served in Haiti, Cavite, Philippine Islands, and during the present war has traveled well in excess of 100,000 miles on inspection trips.

A few approximate figures will show how tremendous our present program is. From July 1, 1940, to July 1, 1945, the Bureau of Yards and Docks has had on its books authorization for a program of approximately $9,500,000,000. Our cash expenditures per month have been as high as $270,000,000. Our maximum contract awards have run well over $350,000,000 per month, nearly four times that for the entire year of 1918 during the last war, and as much as the bureau's contract awards for the 21 years from 1916 to 1937. Our construction program within the continental limits is now well past the peak and the accent is on advance bases. The true measure of our effort, however, is not in money value; it is the importance of our work to the accomplishments of the Fleets, the Air Forces, and the Ground Forces which we have supported.

Our experience in this war has shown that, unprepared as we were, the early progress of the whole war effort depends on the speed with which facilities can be built and put



Official U. S. Navy Photograph

A Floating Dry Dock Anchored in the Shelter of a Far Pacific Island Renders Much-needed Repairs to a Light Cruiser of the Cleveland Class.

into use in the early days. Practically every program of every branch of the Navy Department was dependent on the Bureau of Yards and Docks for the facility which had to be well advanced before these programs could get under way, and which did not exist except to a totally inadequate degree in our pre-war Naval establishment.

Dry Docks

One of the great deficiencies with which the Navy was faced at the beginning of this war was in dry docks for the building and repair of the Fleet. Dry docks are expensive to build and in peacetime are often idle. In wartime, particularly when Naval actions occur on the scale and over the wide areas that are taking place in this one, a great number of dry docks, strategically located, can, by making possible the quick repair and return to active duty of ships damaged in action, be equivalent, in effect, to increasing the Fleet itself. For example, one new capital ship graving dock at Pearl Harbor, which was completed in record time just one week before December 7, 1941, contributed in large measure to the rapid recovery of the Fleet from that blow.

Our dry-dock program has totaled about $750,000,000. The graving docks vary in size from the small destroyer dock to the huge 1100-ft. dock for capital ships. Floating docks of timber, steel, and reinforced concrete vary from the small 1000-ton units to the 100,000-ton sectional capital ship docks. The use of reinforced concrete for floating dry docks is a new innovation. However, they have been most successful, economical, and, in some respects as regards stability, are preferable to steel docks.

Floating docks are used instead of graving docks for three primary reasons: first, because local foundation conditions may be too poor for the safe and quick construction of graving docks; second, because the site may be too inaccessible and remote, necessitating construction at some more convenient location; and, third, and perhaps the most important of all, for mobility of the docks themselves. For maximum efficiency the docks must be close to the Fleets.

The first capital ship sectional floating dry dock placed in operation in the Pacific has now been in constant use for a year and a half. It is an entirely new type from any ever designed or built before. It was under tow on its way out approximately one year from the time the keel of the first section was laid, and it was towed to its destination, assembled, and in operation approximately four months from the time the sections left the West Coast. Subsequent assemblies of similar docks have been made in even shorter time.

Included in our graving dock program have been a large number of shipbuilding docks which have a decided advantage over inclined shipways in that the keel can be laid level which simplifies the laying out and construction of the ship; launching can be accomplished, important particularly in the case of big ships, without any hazard simply by gradually floating them; and generally speaking, all weight-handling is downward rather than upward. I believe that modern battleships have almost reached the limit of size and weight for safe launching from inclined ways.

During the past five years we have built dry docks and marine railways of a very considerably greater capacity than the entire world's docking facilities up to 1938. These, combined with our great shipbuilding capacity and our floating tonnage make us by far the foremost maritime nation of the world. Included in our shipway program were the heavy ways on which our capital ships have been and are being built; and the special ways for mass production, where ships advance progressively from one position to another at successive stages of construction until they are launched from the final position. The full story of the work done at the major Navy Yards—the complex scheduling necessary to avoid disrupting production, the variety of foundation problems encountered, and the many unusual design problems involved, providing for new process and methods—would take a long time to tell.

Weight-Handling Equipment

Another phase of our work which has reached unprecedented volume and complexity has been our weight-handling equipment. Ships are constantly getting larger. The art of welding has brought about new techniques of prefabrication and assembly in larger and larger units. The acceleration of construction has forced a great increase in crane

capacity, reach, speed of operation, and flexibility. Our program has included vast numbers of bridge cranes, locomotive cranes, and gantry, jib and hammerhead cranes, fixed and traveling, of all types and sizes. They are led by our giant outfitting cranes, which have a capacity of 350 long tons at a reach of 115 ft., and which, on overload test, have lifted nearly a million pounds.

Aircraft Hangars

Aircraft hangars, both heavier-than-air and lighter-than-air, of the size necessary, are normally built with structural steel members, but by June, 1942, structural steel became so scarce that then we had to turn to substitutes. The result was wooden hangars of a size never before attempted by the engineers of this or any other country. These lighter-than-air hangars are the largest clear span wooden buildings in the world. They are 171 ft. high, more than 100 ft. long, with a clear span between footings of 237 ft., room to house six blimps. All constructural members were prefabricated and, together with the sheathing, treated with fire-resistant chemicals.

Fuel Storage

The tremendous underground fuel storage built in the Hawaiian Islands will be an epoch in engineering history when the entire story can be told. This was accomplished by contract, prior to, and in the early days of the war. It has a capacity of over 6,000,000 barrels and comprises 20 huge circular vaults, 100 ft. in diameter by 250 ft. in depth. The vaults are of reinforced concrete and lined with thin steel plates. It was truly a construction achievement surpassed by none to date.

Construction Contracts

In normal times construction of the facilities of the Naval Shore Establishment is performed primarily by civilian contract through the medium of lump sum competitive bids. During the last war some urgent work was carried on through the medium of cost-plus-percentage contracts. They were effective in getting work done quickly but they were readily subject to abuses, and hence received much criticism in the postwar period. In this war a negotiated cost-plus-fixed-fee type of contract has been widely used by the Bureau of Yards and Docks very effectively.

Beginning in 1939, extensive developments were undertaken for the Navy by U. S. contractors in the United Kingdom, in Iceland, Newfoundland, Bermuda, the Caribbean, Alaska, the Hawaiians, Philippines, and other islands in the Pacific. We cannot stress too much, or praise too highly, the outstanding accomplishments of our contractors, especially at Midway. For that base a contract for less than $4,000,000 was awarded in August, 1939, to be completed August, 1942. Actually nearly $20,000,000 of work had been completed before the Battle of Midway started June 3, 1942, and the value of the Midway installation is proved by the strategic importance of that victory.

The SeaBees

The complications which arose, when we were attacked, December, 1941, showed the need for a quick change in procedures. Civilian workers cannot be armed or offer resistance to the enemy without being classed as guerrillas; therefore, they have no status as Prisoners-of-War under the Hague Convention, whatever that status might be worth against barbaric enemies like ours. The solution of this problem lay in the creation of our Construction Battalions, the "SeaBees."

Advance and mobile bases are a very vital part of the Fleet and striking forces, particularly in amphibious warfare such as we are now fighting. The assistance in the planning of, the procurement for, and the construction, maintenance, operation and movement of such bases, depots, and shore facilities is where the officers and men of the Construction Battalions have an important and direct military function. Military command functions for officers of the Civil Engineer Corps are new, but responsibility and authority cannot be divorced. The primary mission of the SeaBees is to build; combat functions are secondary but still vital when needed, and so these officers and men are well trained for it and always seem to be happy when they can get in the thick of a fight. One of their proudest boasts is that they are accepted by the Marines as fighting comrades.

The SeaBees afforded an opportunity for construction men, builders and mechanics, particularly the older experienced men, to serve their country in the combatant forces, doing those things for which they are best fitted by training and experience. They were recruited from the men who erected our skyscrapers, built our dams, paved our highways, constructed our railroads. They were given military training and sent out to do their stuff. How well they are performing that duty, the record itself tells. They have been called upon to do almost every form of mechanical work, including a considerable amount of emergency ship repair, particularly in the early days.

The total enlisted personnel is now authorized at 272,000 enlisted

Work in a Floating Dry Dock in the Far Pacific, Just as in the Major Shipyards in the States, Continues Day and Night. Only During Alerts Do the Lights Go Off and Work Discontinued.

Official U. S. Navy Photograph

Official U. S. Navy Photograph

One of the major tasks of the Navy's SeaBees in the Pacific is improving captured Jap airfields. Going to work promptly after the seizure of Eniwetok in February, 1944, they began enlarging the field on the atoll. A bulldozer shoves over a stubborn palm during the clearing of a sector for a new runway.

men. We actually have to date about 255,000. Of this number, approximately 82 per cent are now serving overseas in every theater where the Navy has been and is operating, and another 14 per cent are alerted and standing by for overseas duty. The bulk of the battalions are, of course, in the Pacific, where they have been on the job ever since the pendulum began its backswing at Guadalcanal. In fact, the SeaBees have taken part in every major amphibious operation that American forces have launched, in both the Asiatic-Pacific and European Theaters.

Advance Bases

The term "Advance Base" is a new one developed by this war. Construction of an advanced base involves more than you may realize. Take, for example, an air base—which is one of the least complicated of the bases the SeaBees build. The first job is getting equipment ashore. The second is cutting roads to the scene of operation and getting supplies and equipment off the exposed beach. Then many activities get under way simultaneously. A camp site must be cleared. A source of water supply must be found and developed. Hospital and messing facilities must be set up, gun emplacements built, radio protection installed, access roads pushed through, and construction of an air strip started.

Usually this is a period of operations at maximum speed, because the field is necessary for the protection of the base. Construction goes on from daylight to dark and, if possible, through the night. Where coral is available, it is dug from the earth or blasted and dredged from the sea to provide topping for the field. And when the supply is inadequate or of poor quality, steel matting is laid down as a substitute. Incidentally, coral has been called our "Pacific Lifesaver." The little marine animal, a "Polyp," which manufactures it has certainly been a big ally. It usually takes about two weeks to build a fighter strip from virgin jungle to a condition where planes can land and take off. In one instance, it was accomplished in less than eleven days.

The next step is usually to lengthen and strengthen the field for heavy bombers. Then come other facilities: piers and docks, fuel tanks to be built and camouflaged, power plants, warehouses and shops, more permanent quarters for personnel, recreation facilities, etc. In short, the SeaBees have constructed a streamlined city whose principal industry will be sending bombers farther along the road to Tokyo.

Such a base can and has been built by a single battalion of SeaBees comprising 33 officers and 1081 men serving as an integral part of an all-services Naval air base unit. For other, more extensive bases, such as an all-purpose base to fuel and repair ships, supply the Fleet, and serve the Fleet's air arm, three or more

The 9th U. S. Naval Construction Regiment Lays a Mat on an East-West Runway, the Other Apparently Having Been Completed. This Seems Far Away from the Scenes Showing the Floating Dry Docks and the "Palm" Islands.

Official U. S. Navy Photograph

SeaBees "Hit Bottom"—Build Landing Strip in Former Swamp—

Accomplishing the impossible with their usual aplomb, the Navy's SeaBees are converting a former Philippine swamp into a landing strip that will accommodate planes up to and including heavy bombers. Turning obstacles to their own advantage, they used swamp water to clean out of their trucks the sticky mud that had to be moved; pits dug to reach top-grade coral were filled with the trees and bushes rooted out of the swamp. Navy and Army personnel aided in speeding the project through in an incredible time of little more than three weeks. Ploughing through the mud like an amphibian, this scraper helps to build the airstrip.

Naval Construction Battalions are required. The pattern of construction is much the same, only the shops, the utilities, the warehouses, and all the other facilities are necessarily more extensive. Even so, they are no more elaborate than the minimum necessary to serve their purpose. Many standard and prefabricated structures and equipment have been developed and used interchangeably by both the Navy and Army. Two of the outstanding ones, however, you no doubt have heard of, the versatile Navy pontoons, familiarly known as the "Jeep of the Navy," and the "Quonset Hut."

The basic organization unit of the SeaBees is the Battalion, 1114 officers and men. These have been combined into Regiments of three or more Battalions, and large operations have necessitated the further organization of Brigades, which include two or more Regiments. There were two brigades in the Marianas operation; there was a brigade in the Iwo Jima operation, several on the Okinawa party, and now several in the Philippines. The south and southwest Pacific saw plenty of them also, but that is all history now.

Special Battalions

In addition to the regular battalions, there are what is known as Naval Construction Battalions (Special), and there is an interesting story behind their organization. These include stevedoring battalions recruited from the country's steamship and stevedoring companies and trained at Camp Perry, near Williamsburg, Va. In the early summer of 1943, the first Special battalions left the States. Their officers had had years of experience in stevedoring and the enlisted men had undergone thorough training. One of these battalions arrived at a port where there were 60 ships at anchor. In a month, they had unloaded them at the rate of one a day. In two months, the port was cleared, and new ships were being discharged of cargoes as fast as they arrived. The bottleneck had been broken.

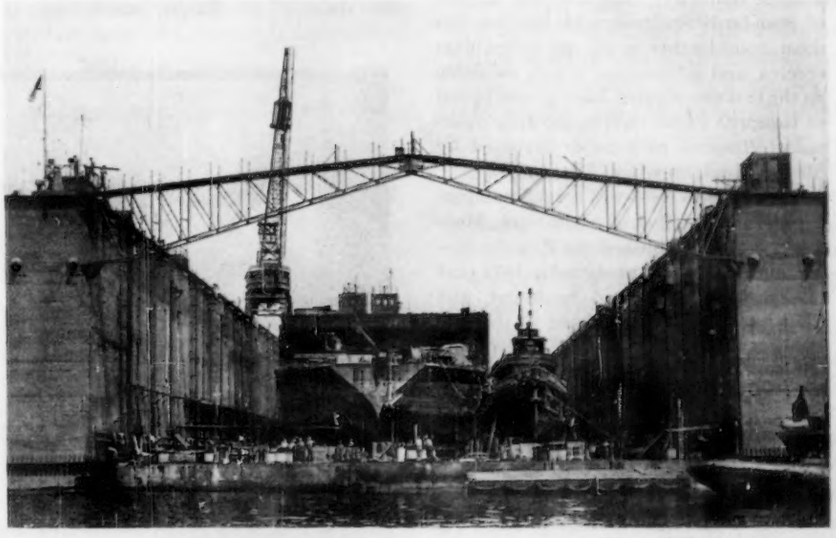
There are a number of other SeaBee units, notable among which are the CBMU's, the Construction Battalion Maintenance Units of approximately 276 officers and men. These boys have the monotonous work of maintaining the bases in the rear areas, and it takes plenty of fortitude to withstand such monotony against all of the tropical handicaps without the excitement of combat. There are also the Pontoon Assembly and Operating Detachments, Equipment Repair Detachments, Harbor Dredging Units, Demolition Units, and others.

Accomplishments

The SeaBees in the Pacific have a saying that they can mend anything but a broken heart. One of their most potent weapons is the bulldozer and what they can do with it is truly astonishing. The story of how a live machine gun nest was plowed under by a SeaBee with a bulldozer is old, but many even more remarkable stories are told of their prowess with this machine. On Iwo Jima, SeaBees with bulldozers reached the top of Mount Suribachi two days before that famous flag-raising picture was taken!

The SeaBees slogan of "Can-Do" and "Will-Do" is typical of their spirit, but there is another final word which must be added to the above and that is "Done." That is not yet but we all fervently hope that it can be written soon. I think it is pertinent to quote from Admiral King's first and second reports on the war.

"The accomplishments of the SeaBees have been one of the outstanding features of the war. There can be no doubt that they constitute an invaluable component of our Navy.



Official U. S. Navy Photograph

Floating dry docks, used in the Pacific in making essential repairs to battle-damaged ships on the spot, are large enough to accommodate many small ships at the same time. A bow-on view shows a floating dry dock, better known in the Navy as an "ABSD" (Advance Base Sectional Docks), servicing an ABD and a YT.

Their ingenuity and fortitude have become a legend in the Naval service. With both tools and tommy guns, they have rendered vital aid on every assignment they have been given."

What is the significance of these tremendous operations? The work of the Civil Engineer Corps and the Construction Battalions of the Navy has only one reason for being. It is to support the operations of the Fleet, including Naval Aviation, and of the Marines. The operations in the Pacific have served to confirm the definite conclusion that every Naval ship or aircraft of whatever type or size is dependent upon shore-based facilities for its operation, maintenance, and support. All inclusive of our war effort in every theater, suffice it to say that the results and successes of all of the combatant forces throughout the world are indicative of the support they are receiving from the service forces, both Army and Navy.

Columbium and Germanium

Editor's Note: The following information about two metals may be of interest to many of the members. The data on columbium are from the June *Technical News Bulletin* of the National Bureau of Standards and on germanium from the June *Monsanto Magazine.*

UNTIL 1929 when Dr. C. W. Balke (now active in the work of A.S.T.M. Committee B-9 on Metal Powders and Metal Powder Products) exhibited sheets and rods of columbium, it was a very rare metal, although Charles Hatchett, an English chemist in 1801 had named an element which he discovered, columbium, and previous to that the ore had been picked up by John Winthrop, first Governor of Connecticut. The metal was first prepared in 1864, but for the next 65 years was primarily a scientific curiosity. In recent years columbium has been an important alloy of iron and steel and it is one of the elements specified in some of the A.S.T.M. requirements for steels for high-temperature service.

The alloys resulting from a use of columbium are very complex, but through spectrographic methods, analysis can be made without difficulty. The National Bureau of Standards Spectrographic Section has done considerable work on columbium spectra, and information is now available on the first two spectra, having been issued as Research Paper 1656 in the June *Journal of Research* as a paper prepared by Messrs. Humphreys and Meggers.

Although the history of germanium parallels somewhat that of columbium, Mendelyeev, who established the Periodic System of the elements, predicted in 1871 that several new ones would be found, and Clemens Winkler isolated one of these in 1886, calling it germanium. The results fulfilled Mendelyeev's prophecy phenomenally closely. Some years ago the Eagle-Picher Co. discovered the rare element somewhat concentrated in waste products from its zinc smelter. Research was conducted to develop feasible methods of concentrating, separating and purifying the metal. When work started the price of the metal was in the range of $4500 per lb., but with production increasing, it is now around $200 per lb. Last fall the world's biggest shipment was made—15 lb. While complete data about the element are not available, it has many interesting possibilities. It expands on cooling; traces of it in magnesium and alloy castings are said to make the alloys more resistant to fatigue and corrosion; its alloys with gold have many possible uses and the oxide has the ability to impart special refractive properties to optical glass.

Some idea of the work involved in obtaining the metal is the fact that only 5 to 10 lb. can be eventually recovered from 15,000 tons of the zinc and lead ores processed daily at the Eagle-Picher Central Mill.

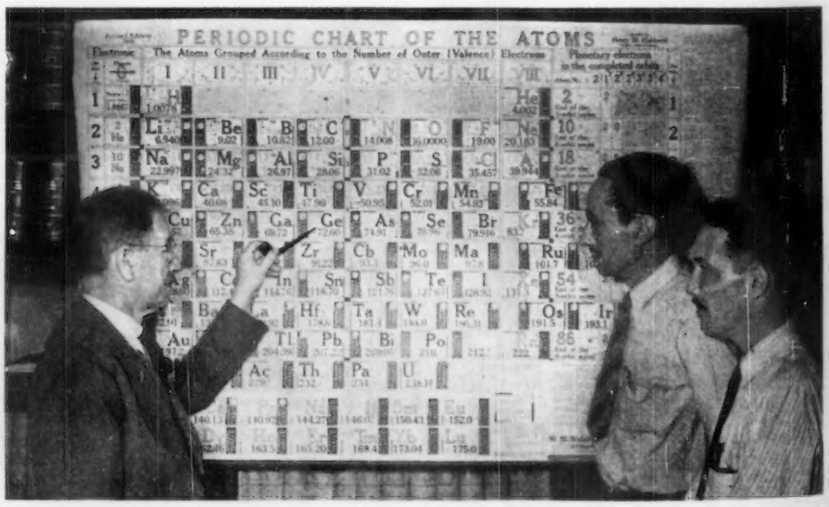
The accompanying photograph shows a periodic chart of the elements, with Messrs. E. W. McMullen, Research Director of Eagle Picher Co. and member of the A.S.T.M. Executive Committee, (left), H. R. Harner, and C. J. Sommerville. Mr. McMullen has advised that because of the absorption of arsine which was generated from a new raw material used in the process, Mr. Sommerville, who did most of the work on the element died after a severe illness of several days, a martyr to science.

The editor of the *Monsanto Magazine*, is Howard A. Marple, well-known to many A.S.T.M. members from his previous connections in the scientific apparatus field.

Effect of Polishing the Base Metal Upon Electroplated Coatings

To determine what effects are produced upon the protective value of electroplated coatings by differences in the degree or method of polishing the base metal, Messrs. Lux and Blum of the National Bureau of Standards according to a paper (RP1645), published in the April *Journal of Research*, took strips of cold-rolled steel and after polishing with a wide range of abrasive grains, plated the strips with copper, nickel, and chromium.

The exposure tests showed that the wide differences in the surface finish produced practically no effects upon the protective value of the coatings. Results in accelerated tests, such as the salt spray, were less reproducible and consistent than in the atmospheric tests. The failure to observe effects of polishing may be accounted for by the use in this study of a high-grade cold-rolled steel that had less inclusions than may be present in hot-rolled steel. It is planned to extend the study to include other grades of steel, and also brass and zinc-base die-castings.



E. W. McMullen, Eagle-Picher research director, traces the unusual life history of germanium for his associates, H. R. Harner and C. J. Sommerville. Described in 1871 by Mendelyeev, its discovery fifteen years later by Winkler incredibly fulfilled the Russian chemist's prophecy.

Preparations for the Future of the A.S.T.M.

Annual Address by the President

P. H. Bates[1]

June 27, 1945

THIS annual meeting of our Society is different in practically every respect from any that have been held before. In this very much abbreviated meeting it is desirable that the Presidential Address should also be brief. As it is essentially a business meeting with a minimum of technical discussions, it is befitting that the address be nontechnical. Also, as all of us under the present world conditions are in an uncertain and unusual transitional period, it would seem desirable that we give our attention to what we as a Society are now doing and have been doing in the immediate past that will affect our activities in the immediate future.

It might be said that what could be presented under such a topic would in a sense be the report of the Special Study Committee. (The final report of this committee is now being prepared for submission to the Executive Committee.) This is correct and what I shall say here will largely be somewhat of a discussion of some phases of its findings and remarks regarding their application. This committee was appointed about two years ago to review in a broad manner how the Society was organized, how it is now pursuing its technical work and how it was presenting the results of such work to the public. Having noted these and also having compared these with what other societies were doing, it was to decide whether these were being carried out in an efficient, effective manner. If such was the case, did the future indicate that changes should be made? Lastly, and particularly, should the Society expand into new fields?

The Study Committee has done a thorough, painstaking, excellent piece of work. Its recommendations when put into effect, as they are rapidly being done, will surely result in all that was and could be hoped for. These recommendations are those of a committee and not of an individual. As such they represent the consensus of opinion of a group. Consequently, they are neither extremely radical nor extremely conservative—they are just about in the center, despite the fact that to some the committee has gone too far. To others it has not gone far enough. To me, personally, it has gone a little to the right of the center, while, as you might infer, I would have preferred it to have wandered a little to the left.

I am for a thoroughly aggressive Society—one that might be accused of committing sins of commission rather than sins of omission. If there is doubt as to whether something should or should not be done, then surely do it. This should be borne in mind as we proceed in this discussion.

That we have an aggressive Society is shown, first, by the fact that it has attained through its up-to-date and high-quality work, preeminence in this country in the field of preparing Standard Specifications and Standard Test Methods. It is recognized here and abroad as the outstanding organization in this field not only in the United States but in the world. Second by its extending its activities in two fields —Simulated Service Testing including tests on parts and assemblies, and Ultimate Consumer Standards —both of which are so large and so urgently requiring work of the type for which no group is so well fitted as ours.

Our work in these two new fields —new at least so far as our Society is concerned, but otherwise far from new—should very materially expand the Society's contacts. These are indeed very large fields. To date many of those interested in them have not been in close contact with our work. Hence, we must secure the advice and assistance of what might be called strangers to our present procedures. Also entering into new fields we must study them carefully and see how we can apply our usual methods or how they must be modified. From noting what confronts us, it can readily be seen that we are undertaking work which must be entered upon with careful preliminary thought.

I am sure others than myself have frequently wondered why there has been such a lack of activities in these fields. Surely there have always been ultimate consumers. Yet today there are so few ultimate consumer standards that it can be said there are none. Is not this due to the fact that in this case the consumer is the ultimate user—in other words, an individual? And an individual as such, in such work, even though he may be a rugged individual, generally makes very slow and very little progress as long as he acts as an individual. But when he unites with others and becomes an organization working to attain certain results, very likely rapid progress is made. In recent years a number of organizations of ultimate consumers have arisen and they are making progress. Practically all of them will welcome contact with our Society and work with it in securing the needed standards.

Testing of Assemblies also is not new. I had entered upon my life's work (which has always been directly connected with research in developing standard specifications and standard testing methods and their application) but one year when I was detailed to take part in a series of tests of assemblies which lasted for a year. I had the pleasure of being connected with the Pennsylvania Railroad locomotive

[1] Chief, Clay and Silicate Products Div., National Bureau of Standards, Washington, D. C.

testing plant when it was first erected and used at the St. Louis Exposition in 1904. A locomotive is surely an assembly though it might be said that a test of that kind—in general determining the efficiency of a boiler and of a reciprocating engine—is not the kind now contemplated. But it must be said that there were many test procedures used in that work for which our Society now has or will have standard methods, which it did not have at that time due to its recent organization.

It seems certain that through the development of testing procedures for many assemblies—but particularly in bridges, buildings, etc.—we can learn to design them more properly. The airplane designers have been forced to realize, more through efficiency and economy than through engineering that overdesign is just as bad and far more wasteful than underdesign. A certain member of a bridge or any other structure should not be overdesigned just because it is not known with sufficient assurance, through lack of adequate tests or test methods, how it is stressed by adjoining members. The proper development of our contemplated work in Tests of Assemblies should lead to a more intelligent and correct use of and in time the elimination of "factors of safety." At least it is hoped that they will no longer be referred to as "factors of ignorance"—as they now are so aptly characterized.

I am inclined to believe that the A.S.T.M. had not entered this field of assembly testing for two reasons: first, because it was extremely busy in its old established work (this does not hold too much weight with me); secondly, we have been too much restricted in our endeavors by a too narrow interpretation of the words of our charter, "materials of engineering." It is, of course, needful to have a delineation of our field. In general, "materials of engineering" accomplishes that purpose. But when we are in doubt as to whether activities in a certain direction would come within such limits, let us decide that they do and proceed accordingly. Remember our headquarters are in Philadelphia and it is certain that one would not need to go many blocks from our offices there before we could find one of the noted breed of "Philadelphia lawyers" who could well justify almost any work in any field as being wholly concerned with "materials of engineering."

So much for these two new efforts. They are getting under way most auspiciously and it is certain that though careful handling and development must be followed, which at first may seem to show annoyingly slow progress, in due time the hoped-for and required advancements will be made and the Society will be recognized as a leader in these fields.

Our publication policies and program have been a matter of considerable thought on the part of the Publication, Study, and Executive Committees. You can be assured that much thought is still needed. The interests of the A.S.T.M., like those of many other technical societies, are centered in developing and systemizing knowledge (in our case largely the art of testing and its application) and in the broadcasting of this knowledge through publications. In other words, we are publishers. The success of such societies is measured quite accurately by the amount of and broad acceptance of this printed matter. Our success is indicated by the fact that the income from this source now exceeds that from membership dues. Such a fact shows that this feature of our efforts must be a matter of much concern at all times.

But certain specific features in connection with our publications have given concern. The size of our *Proceedings* and Books of Standards and the question of promptness of presenting all material to be released forced a study of how and how often this printed matter should be issued.

The recent deliberations have resulted in one new very desirable procedure, namely, the immediate printing, following acceptance, of all technical papers. This is indeed an excellent step. But there is still before us, unsettled, the size of the *Proceedings* and the Books of Standards. Can the former be reduced by briefing committee reports or by publishing these and more of the technical papers in the BULLETIN, even though this might lead to its more frequent issuing? Can the Books of Standards be reduced by presenting Standard Specifications in one volume and Standard Methods in another? Or why not issue each specification or method separately instead of in book form? This is now being done by some other standardizing groups. Should not the Society have a monthly issue of some kind—as, for instance, a monthly issue of the BULLETIN? These and other questions regarding printing have been extensively discussed and will be more so in the future. Our publication affairs are not upon a truly satisfactory nor final basis.

Before the matter of publications is entirely laid aside, it might be well to give a few minutes to thinking of our meetings, from which come so much of our material for printing. Aside from the question of the desirability of having two meetings so closely together, as the "Spring" and the "Annual" Meetings, have not the meetings developed so that too little time is devoted to technical papers? To me, as somewhat of an "old timer," it seems that in the "good old days" of the past there were relatively more papers and discussions than at the present time. Through technical papers on the various broad phases of testing and the development of test methods and specifications so much of such vital concern to such activities is brought forward that we can hardly do too much to foster them. The custom of holding one or more sessions at the Spring Meeting featuring a symposium on some subject is most excellent. It would be well to have more sessions at the Annual Meeting when papers alone would be presented.

I cannot leave the subject of meetings without a few words regarding exhibits. I wish these could be held more frequently despite the fact that even now without these some of the members have a very full week at the Annual Meeting. But aside from possible financial return to the exhibitor, there are always many returns to the viewer and the membership of the Society is largely in this class. But in all exhibits more effort should be made to have groups and individu-

als—not commercial producers of equipment or apparatus—present examples of their own efforts. In the course of a couple of years well worthwhile new examples of such developments would be available of much interest and benefit to a large number.

Here I would have ended my discussion of our meetings had there not come to hand a copy of a talk, "Science Is Not Magic," by Dr. R. C. Hockett, Scientific Director of the Sugar Research Foundation, Inc. As a text for his talk he used the seventh and eighth verses of Genesis XI. Maybe you will recall that there we have the story of the Tower of Babel—how the Lord broke up a very well-organized cooperative effort (just such as ours is) by a much more effective one of confounding their language so that they did not "speak one another's language."

Everywhere in technical societies we have through almost excessive specialization such a development of "tongues," that as Dr. Hockett says, "at the present time workers in the various branches and divisions of science do not understand each other any too readily and the layman finds the language of all of these quite incomprehensible."

We have had in recent years groups splitting off from others or being newly formed solely because of specialization which led the new group to believe it had nothing in common with the old or any other one. Another new tongue had been born. Committee X-13 of the A.S.T.M. is concerned with a commodity and test methods which in the minds of its members are unique and have nothing in common with the commodities and procedures which concern all the other committees. Hence, it maintains a marked aloofness from and associates but slightly with the full activities of the Society. This should be remedied and can be done by getting even the most distantly related committees to understand one another and seeing what they have in common.

The gist of Dr. Hockett's talk was in presenting the role of the "scientific commentator"—the individual who translates the technical jargon of the specialist into the "language of the street" of the layman. Bear in mind the specialist in any one field is the layman in others. I hope that those placed in the Headquarters Staff as contacts for the several groups of committees will develop into true commentators, who will be able to translate the work of the committees in their group so that the other groups will not only understand what is being done but also why, and to the extent that there will be more frequent intercommittee interest, contacts, and such.

Finally, it would be well if each of these or a Headquarters Editor could prepare prefaces of all papers which would tell all laymen the why and wherefore of the paper and let their fancies run wild as to its possible broad and future application. A paper on determining particle size by air permeability was just a title to 95 per cent of the readers of the Society's BULLETIN. Why the interest in particle size? Who is interested? Who might and will be interested? A good scientific commentator could have written a preface which would have caused the paper to have been read by at least a very large minority of the BULLETIN's readers. Particle size is of concern to the metals group (powder metallurgy, size of abrasives for finishing metals, etc.), to practically all of the committees in the C group, and in the D group remember the importance of pigment grain size, the use of sized inorganic fillers in tars and asphaltums, the use of clay, fuller's earth, talc, etc., whose particle size is so important in the paper, textile, and petroleum industries.

May I close this dissertation on technical commentators to correlate the committee work with the Society so that there may be a more intimate contact and a better understanding between committees and more of an appreciation of each other's work by a "lastly" text (also used by Dr. Hockett)—

> "And the Lord said, 'Behold, the people is one, and they have one language—and now nothing will be restrained from them which they have imagined to do?"—Genesis XI:6.

One of our Society's policies and procedures is, I am sure, provocative of more discussion in the technical committees and in the Executive Committee than all the others combined. Reference is made to the balance of membership of committees as between producers and other interests, the requirements as to the "interest" of committee chairmen and to a less degree the classification of interest for voting purposes of technical committee membership. This has doubtlessly received its usual amount of annual discussion by all concerned during the past year, plus a considerable amount on the part of the Study Committee. After all has been "said and done," the restrictions are just about where they were before the year started and before quite a few previous years started. To my mind, this shows progress—strange as it may seem. It shows that our founders and early organizers did quite well and through the years, despite most frequent extended discussions, we are continuing by confirming their wisdom.

Practically all technical committees are faced with the difficult task of securing adequate interest both as to numbers and activity on the part of the consumer and general interests. But when the field has been well canvassed, the desired results are invariably obtained. If one could measure the "intensity" of the interest applied by the producer, consumer, and general interests, it is quite certain that even with the presently demanded less number of producers, we would find the "intensity" of the producer far exceeding the "intensity" of the two other groups. This cannot be changed though the numerical balance might. But it is hoped this latter will never be done. I feel that if it were, the high regard and esteem of the Society's Standards would be most materially lowered.

It has been my pleasure to have attended meetings of six of our District Committees during the past 14 months. Even though in a few cases the attendance was rather small, the small and the large meetings, as well as those very largely attended, evidenced sufficient interest and enthusiasm to indicate that the idea of having these sectional groups is excellent. Despite the fact that in all

of our large cities one can readily find more meetings of technical societies than one can find time to attend, it is still true that those with something worth while to offer can and do draw good-sized audiences. I believe that all of the District Committees, with assistance from the Society's Headquarters Staff, which will always be promptly and heartily given, could have two meetings yearly with such attractive programs that large audiences would result. Testing and its ramifications are so broad that well-timed discussions of one of its many phases will bring many together. Such meetings will very materially enhance the prestige of the Society and expand its membership. These District Committees should by all means be fostered and further developed in some cases. This is now under way by a new Administrative Committee which is certain to give a good account of itself.

A reorganization and extension of the Society's Headquarters Staff has been authorized and is now being effected. One feature of this is particularly commended and should have your interest and support. Reference is made to the assigning of a member of the staff to keep in contact with each group of technical committees. There will ultimately be a member of the staff following the work of each group of committees; attending the meetings of each committee, keeping these especially informed of the work of the other committees in the group and maintaining a direct helpful contact between headquarters and committee members. These staff members will in no manner dictate to committee officers or interfere with their work. These latter will act with their past customary freedom. This feature of headquarters organization is intended to coordinate the work of the committees and the Society and to have both reflect the thoughts and demands of the public. It is certain to result in a more unified acting Society.

You all know by this time that our Society will during the coming year enjoy for the first time in its history its own home. It has surely been most fortunate in securing this—so favorably located in the heart of Philadelphia on a notable thoroughfare, which with time will surely be enhanced with further beauty, and on a site so strikingly surrounded with literary and technical organizations. Since the Executive Committee decided that the Headquarters should be in an urban rather than suburban area, it is hard to conceive of a more favorable location, to say nothing of the remarkably low cost of acquisition.

All of us hope that in a relatively brief time we shall be in the postwar era. This review of the developments in the Society during the past year—so many of which evolved from a consideration of how the Society should conduct its affairs after the war—I hope will clearly show you that it will be organized and ready to meet the demands of that era. Well settled in its new home with its staff organized according to the new setup and working smoothly as a result of the presently coming practice period, we can be assured that the A.S.T.M. will carry on even more effectively and efficiently than it has in the past, with not only a loyal hard-working staff at Headquarters, but with an equally loyal and hard-working membership.

A New Coating Thickness Gage

By S. Lipson[1]

SYNOPSIS

A new coating thickness gage is described, which employs the electromagnetic principle for determining the thickness of nonmagnetic coatings on steel. The principle of operation is as follows:

As a soft iron core is withdrawn from the field of an energized alternating current solenoid, the magnetic pull upon the core increases. If the solenoid is held in a vertical position over a coated steel article and lowered sufficiently to permit the lower end of the core to contact the surface, the distance through which it must be raised for the pull of the solenoid to overcome the attraction of the core for the ferromagnetic basis metal will vary inversely with the thickness of the coating.

The reproducibility of the instrument was found to range from ±5 per cent for films 0.002 in. thick to ±3 per cent for coatings exceeding 0.002 in. Voltage variations occurring within reasonable limits had no significant effect on the accuracy of the determinations. The experimental instrument, found to measure coating thickness up to 0.008 in., is also characterized by the following properties: (1) simplicity, (2) small size, (3) low cost, and (4) rapid measurement.

LOCAL thickness measurement of coatings on steel by magnetic means is generally considered to be superior to other methods of coating-thickness measurement because of its rapidity and nondestructive nature. At the present time two instruments for this purpose have found wide use in this country. One, the Brenner Magne-Gage[2] developed by the National

[1] Metallurgist, Frankford Arsenal, Philadelphia, Pa.

[2] A. Brenner, "Magnetic Method for Measuring the Thickness of Nonmagnetic Coatings on Iron and Steel," *Journal of Research*, Nat. Bureau Standards, Vol. 20, No. 3, March, 1938, p. 357. (*RP* 1081.)

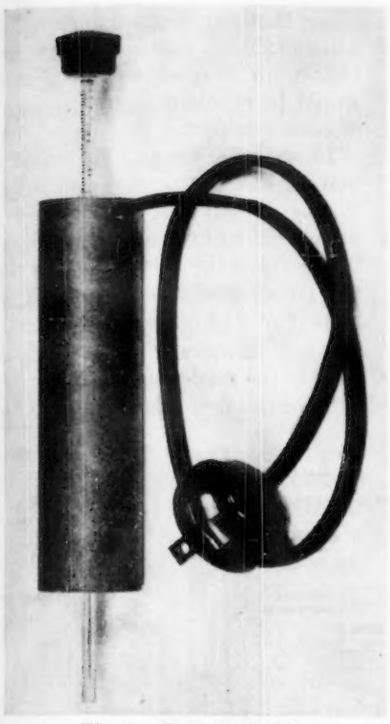


Fig. 1.—Service Model.

Bureau of Standards and manufactured by the American Instrument Co., employs a sensitive spring balance to measure the force required to withdraw a permanent magnet from the surface of the coated article. The instrument may be calibrated to indicate coating thickness since the thinner the coating, the greater will be the force necessary to effect separation.

The other, manufactured by the General Electric Co., is an electromagnetic instrument which measures coating thickness by the amount the flux of a magnetic circuit is reduced by the coating when it comes between the pole pieces of the core and the steel basis metal. Values are obtained directly from a suitably calibrated ammeter.

An alternative coating thickness measuring instrument (nonmagnetic coatings on steel) has been developed at Frankford Arsenal and is described herein.

Principle of Operation

The instrument under discussion requires a source of alternating current which is used to energize a solenoid containing a movable iron core.

If the core is withdrawn from the field of the solenoid, the magnetic pull on the core increases. Therefore, if the energized solenoid is held in a vertical position over a coated steel article and lowered sufficiently to permit the lower end of the core to contact the surface, the distance through which it may be raised for the pull of the solenoid to overcome the attraction of the core for the basis metal will vary inversely with the thickness of the coating.

Design of Instruments

Two experimental instruments were constructed; one was designed for hand-elevation of the coil and the other for mechanical elevation. The latter instrument was intended, primarily, for use in gathering the data, since greater reproducibility was anticipated, while the former was constructed to test the dependability of a simplified design. Hereafter the former will be referred to as the "service model" and the latter as the "research model."

Service Model:

The service model (Fig. 1) consisted of a solenoid which was made by winding approximately $\frac{1}{2}$ lb. of No. 36 enameled copper wire on a bobbin $3\frac{1}{2}$ in. long having a central hole large enough to admit a $\frac{3}{16}$-in. diameter glass tube. An indicating scale was engraved in the upper portion of the tube, and a variety of soft iron cores were made which would slide loosely into the bore of the tube. An indicator, made of light cellulose acetate rod, was attached to one end of the core. Figure 5 shows a schematic representation of this construction.

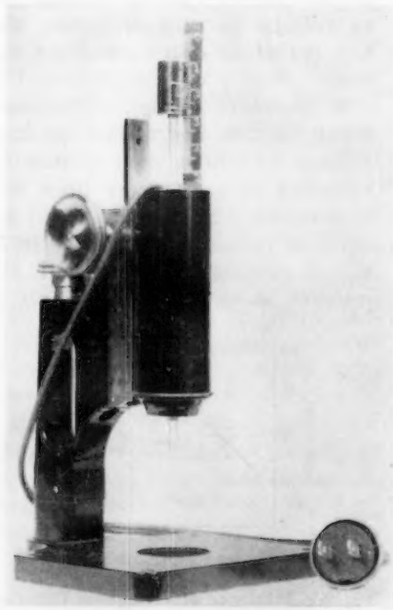


Fig. 2.—Research Model.

When the core is in an equilibrium position in the energized solenoid, its location with reference to the lower edge of the tube can be noted by reading the position of the indicator with reference to the scale.

The instrument is operated by energizing the solenoid (a-c. source), grasping the knob at the end of the tube between the thumb and the forefinger and supporting it in an approximately vertical position. The other fingers are permitted to rest on the side of the tube and help control the speed with which the solenoid is raised, especially just before separation is anticipated. Readings are obtained by raising the coil with the other hand and reading the position of the indicator in relation to the scale when the core has come to rest after being separated from the specimen. Just before separation is effected the chattering of the core (due to the alternating current) warns the operator to proceed slowly from this point. The discontinuance of the chatter plus the appearance of the indicator in the view of the operator signifies the end point.

Research Model:

The research instrument (Fig. 2), designed for mechanical elevation, was constructed in a manner similar to the service model except that the solenoid was placed in the tube of a microscope from which the objective and eyepiece had been removed. The $\frac{3}{16}$-in. diameter glass tube was fitted with a vernier scale at its upper extremity and a vertical scale, arbitrarily graduated from 0 to 50, was mounted on the tube so that the vernier would move parallel to it. It is to be noted that an indicator on top of the core was not employed in this instrument.

Determinations are made by placing the specimen beneath the solenoid so that the bottom of the glass tube rests on its surface. The solenoid is then lowered, by means of the screw on the microscope stand, until the core contacts the surface of the specimen, and is then raised again until separation of the

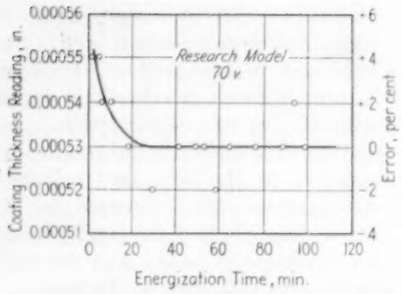


Fig. 3.—Influence of Time on Thickness Reading.

core is effected. Warning of this occurrence is given the operator in the same manner as when the service model is used.

Calibration

Calibration of the research model necessitated an investigation of the effect the following variables exercised on the accuracy and reproducibility of the determinations:

(*a*) Voltage.
  1. Line-voltage fluctuation.
  2. Solenoid voltage.

(*b*) Core size.
  1. Length of core.
  2. Diameter of core.

(*c*) Heating of coil.

(*d*) Miscellaneous factors.

(*e*) Reproducibility (uncontrolled factors).

Methods of Calibration and Results

The instrument was connected to a Variac[2] and an a-c. voltmeter was inserted in the circuit to measure the potential across the solenoid. The following National Bureau of Standards coating thickness standards of nonmagnetic coatings on steel were used in the calibration:

Standard	Coating Thickness, in.
N.B.S. AA 1017	0.00023
N.B.S. AB 915	0.00053
N.B.S. AC 973	0.00114
N.B.S. AF 133	0.00138
N.B.S. AD 1021	0.00195
N.B.S. CB 118	0.00325
N.B.S. CC 36	0.0052
N.B.S. CV 153	0.0087

(A) Voltage:

1. *Line-Voltage Fluctuation.*—Normal Frankford Arsenal line-voltage fluctuation was found to have a negligible effect on the instrument. Figure 3 shows average values obtained during a test period of 100 min. The change in reading during the first 20 min. of test was found to be due to the heating of the coil and will be later discussed in greater detail. Error attributable to voltage fluctuation during this test period did not exceed ±1 per cent.

2. *Solenoid Voltage.*—The sensitivity of the instrument to line-voltage variations such as may be expected in a-c. power lines was determined. Figure 4 shows the effect of voltage variation (60 to 75 v.) on readings obtained with the research model instrument. It is noted that significant differences are attributable to voltage changes and the calibration of the instrument would be required at the beginning of each test period.

In studying the physical effect of voltage changes on the instrument, it was noted that an increase in voltage caused the core to be drawn further into the solenoid; also that the position of the solenoid at the instant of separation was somewhat lower with reference to the lower edge of the guide tube.

Since the first effect tends to cancel the second, it was thought that if both were considered, there might be a certain voltage range where the former would compensate for change in the latter. A comparison was therefore made of values obtained by noting the position of the indicator (service model) and noting the position of the solenoid when separation of the core was effected.

Figure 5 shows the anticipated effect of the compensating indicator. Figure 6 demonstrates the experi-

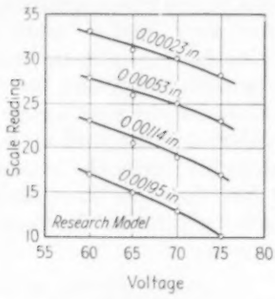


Fig. 4.—Influence of Voltage on Scale Reading.

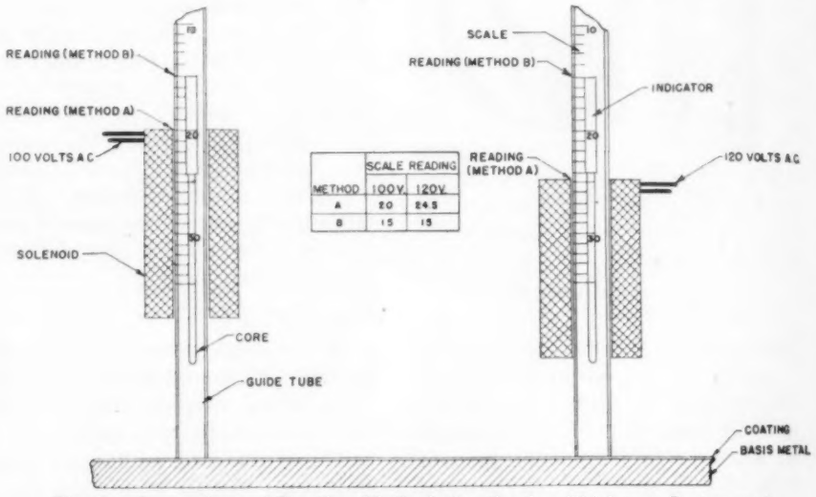


Fig. 5.—Comparison of Reading Methods for Coating Thickness Instrument.
Note.—Voltage compensating effect of indicator (Method B).

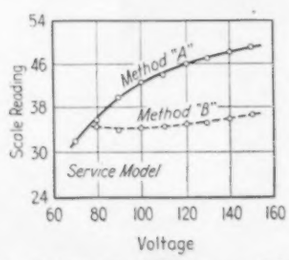


Fig. 6.—Influence of Voltage on Different Reading Methods.

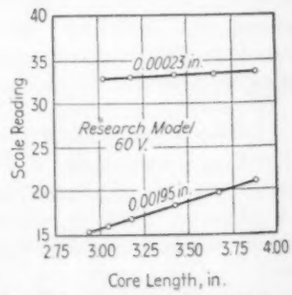


Fig. 7.—Effect of Core Length on Scale Reading.

[2] General Radio Co.

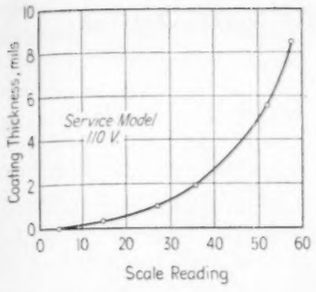


Fig. 8.—Typical Calibration Curve for Nonmagnetic Coatings on Steel.

mental verification of the hypothesis and shows that for voltage changes from 80 to 120 v. no significant change in scale reading occurs when the compensating indicator is read.

(*b*) *Core Size:*

The effect of length of core on the calibration was explored by taking a long core and determining the change in calibration effected by shortening it. The original point contour (hemispherical) was retained during this test by shortening the core from the upper end. Figure 7 graphically demonstrates this effect.

It is noted that as the length of the core diminishes there is a broadening effect on the scale. This is accompanied by a tendency to raise the range, since by the time the length of the core has been reduced to $2\frac{13}{16}$ in., values for the 0.00023-in. thickness standard could no longer be obtained.

The greatest core diameter possible has been found to be most desirable; however, this is limited by the design and efficiency of the solenoid. With the coils used for these experiments, a 0.062-in. diameter core was employed. Figure 8 shows a typical calibration covering the range from 0 to 8 mils.

(*c*) *Heating of the Coil:*

The heating of the coil is naturally dependent on its design, gage of solenoid wire, impressed voltage, etc. The coils used for these experiments showed only a small error attributable to changes in solenoid temperature from room temperature to its operating value. Figure 3 shows the magnitude and duration of this effect. It is believed that the 2 per cent maximum error at the beginning of the test period may be materially lessened by increasing the number of turns in the coil.

(*d*) *Miscellaneous Factors:*

This instrument is, of course, heir to many of the difficulties encountered by other magnetic-type coating-thickness instruments. The composition, heat treatment and structure of the basis metal all affect the scale readings to varying degrees. However, since an overwhelming proportion of finished steel articles are fabricated from mild steels, a calibration for this material would satisfy most needs. If the basis metal should be of a radically different nature, a separate calibration is, of course, necessary.

Variations in the thickness of the basis metal are also responsible for certain errors. Brenner[2] has shown that where basis metal thicknesses exceed 0.015 in., thickness variations have little effect on the accuracy of the Magne-Gage. This work has been verified for the present instrument using feeler gage stock ranging from 0.0015 in. to 0.075 in., and in general[1], it was concluded that where the basis metal exceeds 0.015 in. in thickness no significant error may be anticipated from this source.

Sensitivity to vibration and shock, though not measured quantitatively, has been found to be quite low. Variation in vertical alignment of the gage, within reasonable limits, has likewise been found to exert a negligible influence on the reproducibility.

(*e*) *Reproducibility (Uncontrolled Factors)*:

The reproducibility of the instrument was determined by taking 100 readings at a single spot on the thickness standard (0.00053 in.). The results of this test are shown in Fig. 9. The standard deviation for these scale readings was calculated to be 0.116. This, using the $\pm 3\ \sigma$ limit, is comparable to ± 4 per cent error for the thickness range.

When similar tests were conducted using the service model, the maximum error was approximately

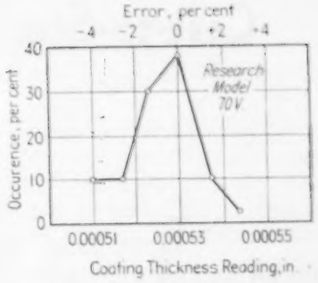


Fig. 9.—Reproducibility of Thickness Determinations.

± 5 per cent in the 0.0002-in. range and ± 3 per cent in the 0.002-in. thickness band. It is believed that this reproducibility is greater than the usual uniformity of the coating, especially in the lower ranges, and should be adequate for most practical uses.

Discussion

The question of the service model *versus* the research model is, of course, dependent on the accuracy desired. However, for most applications the service model is desirable because of the following characteristics:

1. Greater simplicity,
2. More rapid determination,
3. Lower cost, and
4. Voltage-compensating feature.

The voltage-compensating feature may be included in the research model although much of the increased accuracy of this design would be sacrificed since vernier readings from the indicator would probably be impractical.

For special applications, the research model instrument may be preferred, although it would be necessary to calibrate the instrument at the beginning of each test period.

Acknowledgment:

The author wishes to acknowledge the assistance rendered by the members of the Ordnance Laboratory Division, Frankford Arsenal, in particular, by J. K. Desmond, J. Mazia, and T. A. Read.

Cast-to-Size Impact Specimens for Aluminum Sand Casting Alloys

By R. A. Quadt[1]

THE usual procedure for obtaining specimens for impact testing of metals cast in sand involves the machining of the finished specimen from an oversize cast-to-shape test specimen, or the machining of a specimen from a section of a production casting. This is an expensive and time-consuming operation which mitigates against common use of the test except in certain required instances.

The author has been concerned with the development of a body of data relating to the properties of sand-cast aluminum alloys, and in this work it has been desirable to include impact values. The chief deterrent to such a program is the expense and time delay referred to above. Hence it was decided to investigate the possibility of producing cast-to-size impact test specimens in green sand which would satisfy the following criteria:

1. Multiple test specimens from one casting were desired so that a number of specimens would be available for duplicate tests.
2. The test specimens from a single casting should produce reasonably consistent impact values.
3. Test specimens from different castings produced under similar conditions should give comparable results.

It could not be predicted how the impact values obtained would compare with those found on specimens machined as in standard practice, hence machined test specimens were utilized for comparison purposes throughout the investigation.

Method and Data

The type of specimen investigated was the 10 by 10 by 55-mm. Charpy test specimen. Wherever a notch was provided, it was the V type conforming to A.S.T.M. specifications.[2] A wood matchboard similar to the casting shown in Fig. 1 was designed for the initial tests except that no notches were provided in the pattern and specimens were placed closer together. A commercial aluminum 4 per cent copper alloy of the following composition was used for all work in the investigation:

ALLOY F410

Copper, per cent	4.70
Silicon, per cent	1.18
Magnesium, per cent	0.05
Zinc, per cent	0.25
Iron, per cent	0.74
Nickel, per cent	0.02
Manganese, per cent	0.37
Titanium, per cent	0.1
Chromium, per cent	0.005
Aluminum, per cent	Balance

It was melted in a No. 45 clay graphite crucible in a coke-fired, forced draft pit furnace. The crucible was removed when the metal reached a temperature of about 1450 F. A series of castings was poured in green sand molds produced from the matchboard. To determine the optimum pouring temperature for the pattern design, a pair of castings was poured at 1400 F., 1300 F., and at 1220 F. They were shaken out in 15 to 30 min.

It was immediately apparent from this preliminary test that the pattern design was faulty in that the specimens were too close together. The matchboard could not be drawn without disturbing the sand between the specimens; hence this first group of castings contained several specimens which were too rough and misshapen to be used. The remaining specimens were tested in the as-cast and heat-treated tempers and indicated, as expected, that the pouring temperature of 1220 F. gave the highest average values and the lowest spread. This is attributed at least in part to the fact that the smallest grain size (0.5 mm.) resulted from the low pouring temperature.

In order to standardize the testing operation, the parting line surface was always placed parallel to the striking surface on the side away from the hammer. It is the surface, therefore, which sustains the greatest stress. Although both the cope and drag positions were reversed for several tests with no significant difference in the impact resistance, the cope surface was chosen for this purpose since it consistently presented the smoothest surface, and it was hoped that notch effects could be minimized.

Specimens were tested at room temperature on a Baldwin-Southwark modified Charpy impact machine of 16 ft-lb. capacity. The machine design has been adequately described elsewhere.[3] Each scale division represents 0.08 ft-lb. The cast-to-size unnotched specimens in the solution-heat-treated condition exceeded the breaking range of this machine; therefore they were broken in a Riehle 110 ft-lb. capacity

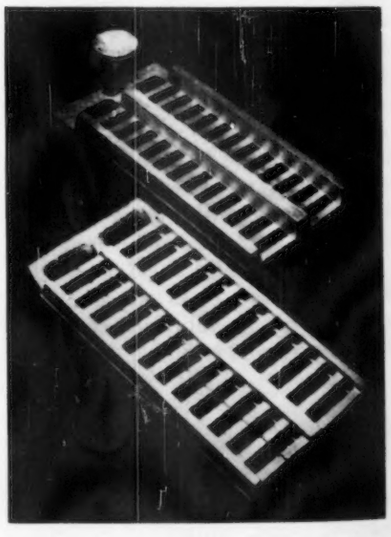


Fig. 1—Aluminum Sand Casting for Producing 26 Cast-to-size 10 by 10-mm. Charpy Impact Specimens.

Top: Cope view.
Bottom: Drag view.

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[1] Central Research Laboratory, American Smelting and Refining Co., Barber, N. J.

[2] Tentative Methods of Impact Testing of Metallic Materials (E 23 – 41 T), 1944 Book of A.S.T.M. Standards, Part I, p. 1962.

[3] R. Burns and W. W. Werring, "The Impact Testing of Plastics," *Proceedings*, Am. Soc. Testing Mats., Vol. 38, Part II, p. 40 (1938).

machine on which the scale is subdivided into 1 ft-lb. increments and values can be estimated to 0.5 ft-lb. Tup velocity was 12.0 ft. per sec. for both machines.

As a result of these exploratory tests, the pattern was revised to the extent that the test specimens were respaced $\frac{5}{8}$ in. apart and contained 26 unnotched specimens. Only about 0.005-in. draft was accorded the test specimens to approximate the desired square section as closely as possible. The alloy was then remelted and a group of castings poured at 1220 F. Specimens were numbered 1 to 26 on each casting starting at the top-right corner opposite the sprue and numbering clockwise. The specimens of two castings were tested in the as-cast condition four days after they were produced. Another set was tested in the solution-heat-treated condition and a fourth and fifth set tested after various aging treatments. Specimens from these last two castings were selected at random since it was desired to duplicate normal procedure. Solution heat treatments were conducted at 960 F. for 15 hr. in an electrically heated, circulating air furnace, quenching in boiling water. Solution-treated specimens were aged 24 hr. at room temperature before being tested or artificially aged. Aging at 310 F. was accomplished in constant temperature, electrically heated salt baths. The results are summarized in Table I. No significant effect due to position in the casting could be determined from the individual results.

TABLE I.—IMPACT STRENGTH OF CAST-TO-SIZE UNNOTCHED SPECIMENS.

Heat Treatment	Number of Specimens	High (ft-lb.)	Low (ft-lb.)	Mean (ft-lb.)
As cast				
First casting	25	10.4	7.3	8.4
Second casting	21	9.2	7.4	8.2
Solution heat treated	31	21.0	15.5	18.5
Solution heat treated and aged 3 hr. at 310 F.	14	15.4	11.9	13.4
Solution heat treated and aged 6 hr. at 310 F.	13	13.7	10.5	12.3
Solution heat treated and aged 24 hr. at 310 F.	13	9.3	5.5	7.3

To obtain comparable values on standard machined and notched specimens, ten test specimens were cut from the bottom of the outside runners where the feeding and freezing characteristics most closely approximated those of the cast-to-size specimens. Grain size determinations averaged 0.7 mm. on the specimens obtained from the runners. Six more specimens were cut from similar locations in other castings and milled 10 mm. square but left unnotched. Finally, notches were machined into fifteen of the cast-to-size bars. All were heat treated and tested as previously described. The impact results are listed in Table II.

TABLE II.—IMPACT STRENGTH, FT-LB.

Heat Treatment	Machined and Unnotched	Machined and V Notched	Cast to Size with Machined V Notch
As cast	4.0	1.4, 1.3	1.8, 1.8, 2.0
Solution heat treated	11.0, 9.7	4.1, 4.7	5.2, 5.7, 5.4
Solution heat treated and aged 3 hr. at 310 F.	7.6	3.0, 3.2	3.0, 3.4, 3.2
Solution heat treated and aged 6 hr. at 310 F.	4.7	2.2, 2.5	2.6, 2.4, 2.8
Solution heat treated and aged 24 hr. at 310 F.	2.7	1.3, 1.4	1.5, 1.5, 2.0

It was decided to attempt to cast the V notch into the specimens directly so a second alteration to the matchboard was made. One half of the specimens had specification V notches cut into the drag surfaces. The casting produced is shown in Fig. 1. The alloy was again remelted and cast at 1220 F. The notched bars from one of the castings were tested about 6 hr. after pouring. The notched bars from other castings were heat treated and tested as before. The results are tabulated in Table III.

TABLE III.—IMPACT STRENGTH OF CAST-TO-SIZE BARS WITH V NOTCH CAST INTO SPECIMEN.

Heat Treatment	Number of Specimens	High (ft-lb.)	Low (ft-lb.)	Mean (ft-lb.)
As cast	13	2.5	1.8	2.1
Solution heat treated	9	5.4	4.1	2.7
Solution heat treated and aged 3 hr. at 310 F.	7	3.0	2.4	4.6
Solution heat treated and aged 6 hr. at 310 F.	7	2.1	1.8	2.0
Solution heat treated and aged 24 hr. at 310 F.	7	1.4	1.2	1.4

The effect of room temperature aging on the as-cast impact properties of this alloy was investigated when it was noted that specimens from the same castings did not check specimens tested at an earlier date. The results are tabulated in Table IV.

These data indicate that the "as-cast" values given for the various types of specimens are not strictly comparable since those specimens requiring machining were obviously aged somewhat in the interim between casting and testing. All machined specimens were tested within a week of casting, however, so the discrepancy due to the aging factor is not too great.

TABLE IV.—EFFECT OF ROOM TEMPERATURE AGING ON IMPACT RESISTANCE IN AS-CAST CONDITION.

Aging Period, days	Unnotched				Notched			
	Number of Tests	High (ft-lb.)	Low (ft-lb.)	Mean (ft-lb.)	Number of Tests	High (ft-lb.)	Low (ft-lb.)	Mean (ft-lb.)
1	12	11.1	8.0	9.8	13	2.5	1.8	2.1
4	46	10.4	7.3	8.3	...	...	...	...
18	7	7.2	5.2	6.2	4	1.3	1.1	1.2
35	4	5.4	4.2	5.0	...	...	...	...

Discussion

Tension test data were obtained on this alloy from standard cast-to-size $\frac{1}{2}$-in. test bars poured at 1220 F. into green sand molds. Properties obtained from these bars are plotted in Fig. 2. Three to five bars were used for each treatment. Impact data from Tables I, II, and III are summarized in Fig. 3. In order that a constant cross-section area might be utilized in comparing the results of the various tests, values were recalculated where necessary to a standard cross-section area of 80 sq. mm. The cast-to-size unnotched specimens approximated 10.5 mm. square due to the vibration required in drawing the pattern. The notches cut in the pattern had the correct angle and root radius but were about $\frac{1}{2}$ mm. too deep. The

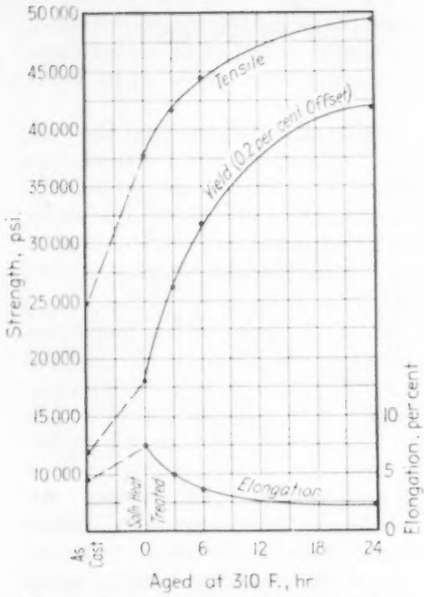

Fig. 2.—Tensile Properties of the Aluminum Alloy Investigated.

dimensions of a particular type of cast specimen, however, checked closely from specimen to specimen, varying but a few thousandths of an inch.

Several interesting observations may be made from the impact curves. Due to the similarity of the three curves in Fig. 3, these remarks apply to any of the tempers investigated. The first concerns the effect of the casting skin on unnotched bars. Except for slight differences in freezing rate in the specimens used to produce curves I and II, the difference in toughness must be attributed to the casting skin. Roughly 50 per cent of the impact resistance of cast-to-size unnotched specimens for this alloy is due to the superior toughness of this outer skin. This skin effect is no longer apparent, however, upon casting a standard V notch into the specimen. The notch completely dominates the test and renders ineffective the superior toughness of the casting skin. Differences among the three types of specimens used to develop curve III are not significant.

Secondly, the notch sensitivity of the alloy is indicated by the difference between curves I and III, and between curves II and III. Stress concentrations due to the notch reduce the toughness of a cast-to-size specimen by approximately two thirds. Machined specimens lose about one half their initial impact strength. The actual energy absorbed in fracturing each type of specimen is essentially the same; hence a notched machined specimen and a notched cast-to-size specimen have the same impact strength.

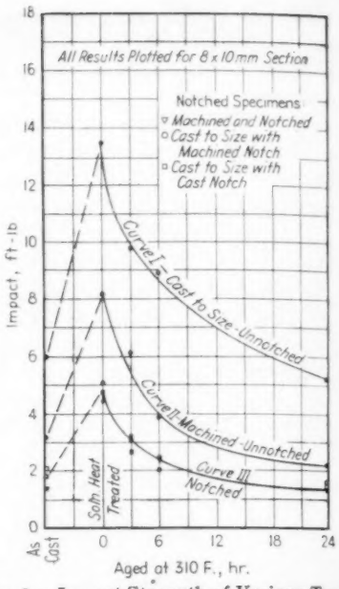
All Results Plotted for 8 x 10 mm Section
Notched Specimens
Machined and Notched
Cast to Size with Machined Notch
Cast to Size with Cast Notch
Curve I: Cast to Size, Unnotched
Curve II: Machined, Unnotched
Curve III Notched
Impact, ft-lb
Soln. Heat Treated
As Cast
Aged at 310 F., hr.

Fig. 3.—Impact Strength of Various Types of Specimens with Constant Cross Section.

Conclusions

The results of this investigation indicate that it is possible to produce quickly and cheaply cast-to-size Charpy impact specimens which satisfy the criteria outlined in the introduction of this paper. Both notched and unnotched test specimens may be obtained from a single sand casting. It is thus possible to obtain data on two sometimes unrelated properties of an alloy: its impact resistance and its sensitivity to notching.[4] This method of producing impact specimens has been incorporated into a research program with very satisfactory results. Several thousand specimens have been cast and tested to date on most of the common aluminum casting alloys. Generally, several impact castings are poured along with the usual tension test bars from a single heat of metal.

For the aluminum alloy reported here, the values obtained from cast-to-size notched specimens closely check those obtained from bars machined and notched from a comparable oversize casting. Unnotched cast-to-size specimens, however, have approximately double the impact values obtained from unnotched machined specimens.

Acknowledgment:

The work reported in this paper is part of a program of research conducted at the Central Research Laboratory of the American Smelting and Refining Co. for the Federated Metals Division.

The guidance and interest of A. A. Smith, Jr., is gratefully acknowledged. Miss Doris Marshall assisted in carrying out the laboratory work.

[4] S. L. Hoyt, "Notched-Bar Testing and Impact Testing," *Proceedings*, Am. Soc. Testing Mats., Vol. 38, Part II, p. 141 (1938).

Compression Testing of Magnesium Alloy Sheet

By A. A. Moore[1] and J. C. McDonald[1]

SYNOPSIS

Methods of compression testing of magnesium alloy sheet are presented, including a rapid means of obtaining an autographic stress-strain curve. This method, which should be satisfactory for other metals, combines an adaptation of the Baldwin-Southwark Model PSH-S extensometer with a Montgomery-Templin type jig.

Results of tests made by various methods, including "pack" and single-sheet, are given for magnesium alloys in thicknesses from 0.016 in. to 0.250 in. The use of a reduced-section specimen is recommended.

DESPITE the fact that the compression test is one of the oldest, good methods of performing this test on all forms of materials have not been available. The most recent developments have been in the field of sheet materials. The "pack" compression method presented by the National Bureau of Standards (1)[2] is satisfactory except that it is time consuming. Montgomery's single-thickness method simplified the machining and set-up. It also decreased the time required to make a test. Various means of supporting the single-sheet specimen have been used (2), and adaptations of autographic strainometers have speeded up the testing process (3).

The purpose of this paper is to discuss the factors encountered in compression testing of sheet-like specimens of magnesium alloys, and to present a rapid method of autographic stress-strain recording which is comparable in speed to that obtained under similar conditions in a tension test. The accuracy of strain recording is good, but the stress measurement includes the frictional component inherent in any means of support.

TEST METHODS

General:

The chief problem in sheet compression testing is to prevent buckling by using lateral support. At the same time, the frictional load must be a minimum. Any material in compression expands laterally even in the elastic range and the amount of frictional load developed depends on the supporting surface and its rigidity. The yield strength is of primary interest in compression testing, and fortunately the error introduced by friction up to this point on the stress-strain curve is small. In single-sheet testing, the specimen is left unsupported at one end to allow sufficient compressive strain for the specimen to reach the yield strength before the platens contact the supporting jig. On very thin material this unsupported end will buckle.

Several methods of supporting the sheet specimens have been used. The pack method (1), as shown in Fig. 1, uses a pack of several pieces of the same material. The individual sheets are cemented together and supported by lateral rods.

Sandwich methods have been used employing smooth flat surfaces clamped to the specimen (2). For a permanent setup where the number of tests make it worth while, the Montgomery-Templin jig is preferred. For any given material, the type of support to be used should be selected after tests have been run by several methods. Flat plates are cheaper and provide support closer to the ends of the specimen than rollers. For this reason they must be used on very thin material. On some magnesium alloys it was found that rollers gave less friction and were preferable to flat polished surfaces. The probable reason for this will be discussed later.

Strainometers and Jig:

Tuckerman gages are used for precise determination of strain, with one mounted on each edge of the sheet specimen. A faster method of strain determination is desirable if the number of tests is large. Since a Templin recorder system was already in use, a setup was devised to record single-sheet compression stress-strain curves autographically (5).

Figure 2 shows the arrangement which includes a Baldwin-Southwark Model PSH-S high-temperature extensometer with the regular adapters replaced by short rigid legs. The legs are equipped with knife-edges which are clamped against the specimen with spring pressure. The gage is held in place by a spring which allows vertical

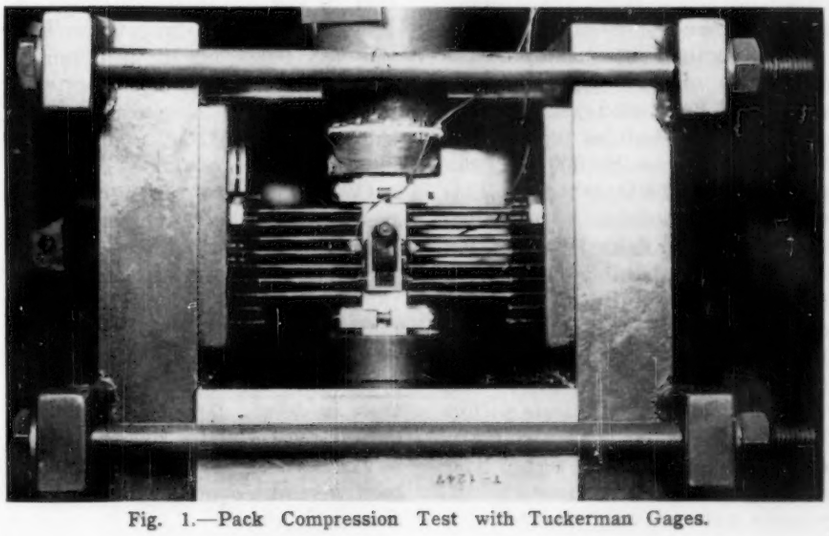

Fig. 1.—Pack Compression Test with Tuckerman Gages.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] The Dow Chemical Co., Midland, Mich.

[2] The boldface numbers in parentheses refer to the list of references appended to this paper.

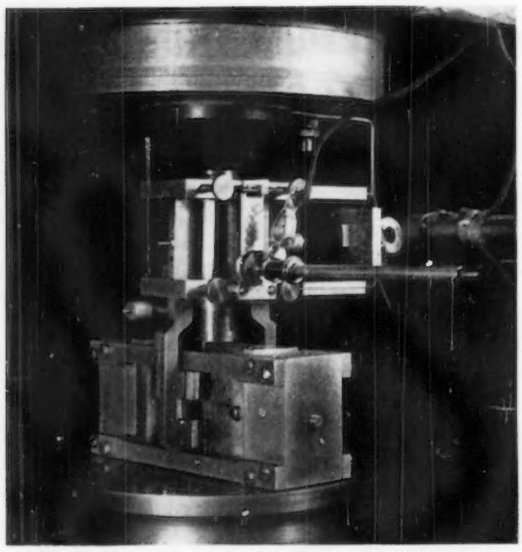

Fig. 2.—Single-Sheet Compression Test with Autographic Gage.

movement. Strain is measured over a 1-in. gage length in the middle of the specimen. Strain readings obtained from opposite sides of the specimen are transmitted to the extensometer, which is of the Peters averaging type. Since the jig restrains bending in all but the one plane, a close approximation of the compression strain is obtained, even if some bending is present.

To insert a new specimen, the knife-edges are pulled apart and the jig moved forward. The knife-edges are rested on the jig while the specimen is changed and then the process is reversed. The gage length is determined by the knife-edges which are locked together until after the specimen is in place. A completed compression stress-strain curve on single sheet takes about as much time as for tension.

This method was adopted to make use of the single-sheet jig which had been used with Tuckerman gages. Modulus values obtained vary about 200,000 psi. from a mean of 6,500,000 psi. This variation in modulus is less than that usually obtained in tension tests with comparable equipment. The recorder and testing machine were of the type usually used for control purposes and no special calibration factors were used. The testing machine was accurate within 0.5 per cent when calibrated with a Morehouse proving ring. The accuracy of the extensometer and recorder was checked by means of a comparator against a calibrated Tuckerman gage and was accurate within 0.0001 in. No attempt was made to control the room temperature other than the regular heating system thermostats.

The jig shown is similar to the Montgomery-Templin and is 2.600 in. long. Rollers 0.095 in. in diameter were used first but were later changed for ones 0.064 in. in diameter. The flat supporting surfaces used are ground and highly polished.

Test Specimen

The regular rectangular specimen was tried first. It was found that at least 0.045 in. extra was needed on magnesium sheet alloys in addition to the jig length of 2.600 in. For the 0.064-in. diameter rollers, this left 0.077 in. of unsupported material. Buckling was encountered on some of the stronger alloys at a thickness of 0.032 in. when 0.064-in. rollers were used.

Cementing two or more thicknesses of thin sheet together to form a pack for use with the single-sheet jig did not help much in eliminating the tendency to buckle. Another method tried was to put a reduced section in the middle of the test specimen. Sheet 0.025 in. could then be tested before buckling occurred between the rollers. Other advantages for this type of specimen were discovered which will be discussed later.

Flat plate supports were tried with reduced-section specimens and material down to 0.016 in. thick was tested successfully. Tests were then run to determine how the use of the various supporting surfaces affected the test results.

Results of Tests

The various types of stress-strain curves obtained in compression of magnesium alloys have been published elsewhere (**4**). Metallurgical factors, such as orientation, determine the type of compression stress-strain curve which may be obtained. Some compression curves are similar to the tension curves but others are different. For purposes of illustration, two types of compression curves are shown in Fig. 3. One is of Dowmetal O-1HTA[3] extrusions, where the curve deviates gradually from the modulus line much as in tension. The other is of 0.064-in. thick Dowmetal FS-1a sheet which exhibits a sharp knee similar to that obtained with mild steel. In this material, Lueder's lines appear, as in steel, at the yield point. Consequently, the yield strength may be determined satisfactorily by the drop-of-beam method.

The stress-strain curves in Fig. 3 were made autographically with the

[3] See Table IV for compositions.

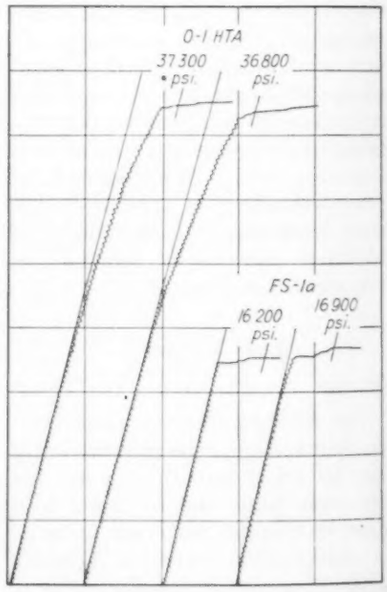

Fig. 3.—Compressive Stress-Strain Curves of Extruded Dowmetal O-1HTA and of Dowmetal FS-1a Sheet.
Load—200 lb. per division.
Strain—3.45 per cent per division.
Modulus lines—6,500,000 psi.

TABLE I.—COMPARISON OF PACK METHOD TO PLATE SUPPORT AND ROLLER SUPPORT.

Values shown are the average of three tests.

Alloy	Gage, in.	Direction of Testing	Yield Strength, psi. Flat Plate	Rollers	Pack
FS-1a	0.125	Long.	19 200	17 700	17 800
		Trans.	19 400	17 600	17 600
	0.064	Long.	18 100	18 300	17 900
		Trans.	19 000	19 400	19 000
FS-1h	0.125	Long.	29 400	28 400	29 200
		Trans.	29 600	29 500	29 800
	0.064	Long.	30 500	30 100	30 300
		Trans.	32 700	32 100	31 500
Ma	0.125	Long.	14 800	13 800	13 600
		Trans.	13 600	12 600	12 600
	0.064	Long.	12 100	12 500	12 600
		Trans.	13 100	12 900	13 100
Mh	0.125	Long.	18 300	18 000	17 800
		Trans.	17 100	16 800	17 400
	0.064	Long.	20 000	19 400	19 500
		Trans.	18 200	17 900	17 900

apparatus shown in Fig. 2 using reduced-section specimens. It will be noticed that the strain magnification is 290 to 1. While the nominal magnification used is 250 to 1, the actual magnification is as given because the extensometer was used with a different recorder than the one for which it was designed. The strain is recorded by a reverse arrangement of the extensometer legs, so that the curve bears to the right, as in tension. This is done for convenience in recording.

When a rectangular specimen of FS-1a was used, the Lueder's lines were observed to start from one end of the specimen, generally the projecting end. As the test progressed, the lines proceeded toward the middle of the specimen. The specimen showed a local thickening at the Lueder's lines and wedged in the jig. All strain was absorbed locally and none was obtained from the 1-in. gage length in the middle of the specimen. This gave a considerable *wait* with neither stress nor strain being recorded. It was also found that the frictional load caused by the thickening was greater with flat plates than with roller supporting surfaces. This is shown in Table I, especially for the 0.125-in. thick annealed sheet.

Lueder's lines are found after compression on cold-rolled sheet and on extruded material. The effect is less pronounced on the stronger material with less local thickening. The results of tests were about the same on cold-rolled sheet regardless of whether roller or flat plate supports were used.

The use of a reduced section $1\frac{1}{4}$ in. long with an area about 15 per cent less than the ends eliminated the Lueder's lines, except in the reduced section, and decreased the frictional load in some cases, as will be seen from Table II. Alloy FS-1a gave much lower values when a reduced section was used. With all of the plastic strain taking place in the reduced section the specimen length was changed to 2.630 in. The standard specimen in use at the present time is shown in Fig. 4.

It is recognized that any form of support will give a higher value. This is shown by Table II where specimens from $\frac{1}{4}$-in. plate were tested as a single sheet with roller supports, as a pack, and unsupported. The unsupported specimens were 2 in. long and $\frac{3}{4}$ in. wide. The strain was measured over a 1-in. gage length in the middle. The average of all tests on $\frac{1}{4}$-in. plate shows the unsupported specimens to have a yield strength 4.4 per cent lower than the average of the values obtained with reduced-section specimens supported by roller surfaces. Individual values ranged from 3.2 to 9.0 per cent lower but part of this may be due to material variation.

Sheets 0.125 in. and 0.064 in. thick were tested for a comparison of single-sheet results with the pack method. Good agreement was obtained between the pack and single-sheet methods; especially if rollers were used. The pack specimens buckled below the yield strength when 0.032-in. Dowmetal FS-1h sheet was tested.

Table III shows the results of tests on 0.016-in. FS-1a and FS-1h sheet. Reduced-section specimens were used. None of those tested with flat plates buckled, while those

TABLE III.—COMPARISON OF ROLLER SUPPORT TO PLATE SUPPORT FOR 0.016-IN. SHEET SPECIMENS WITH REDUCED SECTIONS.

Values shown are the average of two tests.

Alloy	Gage, in.	Direction of Testing	Yield Strength, psi. Flat Plate	Rollers
FS-1a	0.016	Long.	18 300	18 200[a]
		Trans.	18 600	18 000[a]
FS-1h	0.016	Long.	29 600	29 000[a]
		Trans.	30 700	29 000[a]

[a] Buckled.

TABLE IV.—NOMINAL CHEMICAL COMPOSITION OF MAGNESIUM-BASE ALLOYS TESTED, PER CENT.

Alloy	Aluminum	Manganese, min.	Zinc	Iron, max.	Nickel, max.
Dowmetal FS-1	3.0	0.2	1.0	0.005	0.005
Dowmetal J-1	6.5	0.15	0.9	0.005	0.005
Dowmetal M	...	1.2	...	...	...
Dowmetal O-1	8.5	0.15	0.5	0.005	0.005

TABLE II.—COMPARISON OF VARIOUS SUPPORTS TO NO SUPPORT.

Values shown are the average of two tests.

Alloy	Gage, in.	Direction of Testing	Yield Strength, psi. Roller Supports: Plain Bar	Roller Supports: Reduced-Section Bar	Pack	Specimen 2 in. Long No Support
FS-1a	0.250	Long.	15 400	15 300	15 600	14 600
		Trans.	16 300	15 900	15 900	15 000
FS-1h	0.250	Long.	27 600	27 800	27 900	26 900
		Trans.	31 200	31 300	31 300	30 300
J-1a	0.250	Long.	15 100	15 100	14 700	14 600
		Trans.	15 700	15 900	15 500	15 400
J-1h	0.250	Long.	25 100	25 500	26 300	24 800
		Trans.	29 300	29 700	30 300	28 500
Ma	0.250	Long.	11 800	11 500	11 600	11 100
		Trans.	10 900	10 900	10 900	9 900
FS-1a	0.032	Long.	17 700	17 100	17 600	....
		Trans.	20 100	18 600	18 200	....
FS-1h	0.032	Long.	31 400	31 800	[a]	....
		Trans.	32 800	33 200	[a]	....

[a] Buckled below yield strength.

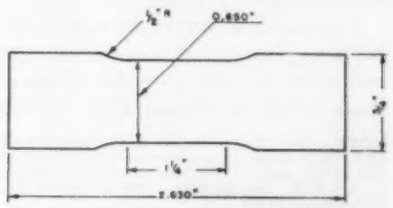

Fig. 4.—Reduced-Section Specimen.

tested with roller supports did. In all cases the yield strength was apparently reached before buckling as shown by comparison with the results from the tests made with flat plate supports. Buckling is always undesirable because it is never known whether it occurred below the yield strength or not.

From the tables presented, it will be noted that the annealed sheet (designated by the letter *a*) was more sensitive to test methods than the cold-rolled or stronger alloys (designated by the letter *h*) which are generally used in stressed applications. This also applies to single-sheet specimens machined from extrusions, such as angles, channels, and tees, that is, stronger alloys are less sensitive than the weaker alloys.

Summary

1. On commercial Dowmetal sheet alloys the regular pack method with supporting rods $\frac{1}{4}$ in. apart could be used for 0.064-in. sheet. The 0.032-in. sheet buckled.

2. Accurate compression stress-strain curves may be obtained in single-sheet tests by use of regular autographic equipment with a suitable jig.

3. In single-sheet specimens the following limiting minimum thicknesses were found:

(*a*) Flat plate supports, reduced section specimen—less than 0.016 in.

(*b*) 0.064-in. diameter roller supports, rectangular specimen—0.032 in.

(*c*) 0.064-in. diameter roller supports, reduced section specimen—0.025 in.

4. Some magnesium sheet alloys exhibit a sharp-kneed compressive stress-strain curve accompanied by pronounced Lueder's lines similar to tension on mild steel.

5. The use of a reduced-section single-sheet specimen is recommended for some alloys and conditions.

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Effect of Heat on Portland Cements Containing Vinsol Resin

By Leonard Bean[1] and Albert Litvin[1]

It has been reported by some manufacturers of Vinsol resin cements that large losses of resin have occurred sometime during the manufacturing processes. One mill experienced losses as high as 75 per cent of the resin added to the clinker. At this plant it was claimed that during the finish grinding process the odor of Vinsol resin was quite pronounced. Officials of the company reported that in the freshly ground cement temperatures as high as 300 F. or even 350 F. were frequently found.

The problem was presented to the National Bureau of Standards in an endeavor to ascertain the cause of these losses of Vinsol resin during grinding and what effect they might have on the air-entraining properties of the finished cement. A study of this problem was accordingly undertaken.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] National Bureau of Standards, Washington, D. C.

Scope of Tests

The effects of duration and intensity of heating of powdered Vinsol resin on its weight, its chloroform-soluble content, its methoxyl content, and its air-entraining properties were determined by heating Vinsol resin alone and as interground in cement. Two methods of heating were employed, oven heating and heating in a laboratory rotary calciner. The effect of fineness of Vinsol resin intermixed with cement on the air-entraining properties of the cement was also studied.

TABLE I.—EFFECT OF HEATING AT 300 F. ON VINSOL RESIN, AND ON CEMENT-VINSOL RESIN MIXTURE.

The second column shows Vinsol resin found by the methoxyl method; the third column is a calculation of resin lost, based on the original amount present shown in the second column; the fourth column shows losses based entirely on change in weight.

Total Time Heated, hr.	Cement-Vinsol Resin Mixture		Straight Vinsol Resin
	Resin Found, per cent by weight of cement	Resin Lost, per cent of 0.031	Resin Lost, per cent
0	0.031	0	0
2	0.025	19	19
4	...	..	20
6	...	..	22
8	0.020	36	23
10	...	..	23
14	0.018	42	23
31	0.009	71	24
51	0.009	71	25

Experimental Procedure and Results

Oven Heating:

One kilogram of cement was mixed with 0.045 per cent of its weight of Vinsol resin in a small pebble mill. The cement was removed and analyzed for Vinsol resin by the methoxyl method.[2] Only

[2] 1944 Book of A.S.T.M. Standards, Part II, p. 1223.

TABLE II.—EFFECT OF SPECIFIC SURFACE ON THE AIR-ENTRAINING PROPERTIES OF VINSOL RESIN.

Vinsol Resin Added, per cent	Specific Surface of Vinsol Resin Added, sq. cm. per g.[a]	$CHCl_3$ Soluble Extract Found, per cent	Vinsol Resin Calculated from CH_3O, per cent	Air in Mortar, per cent	Flow, per cent
None	...	...	...	5.8	116
0.040	2 500	0.039	0.043	8.4	125
0.040	13 000	0.039	0.044	12.2	133

[a] The specific surface was determined by the air-permeability apparatus.

0.031 per cent was found, indicating a large loss on the pebbles and the container.

This treated cement was then heated at 300 F. for varying periods. The heating was accomplished by placing the beaker containing the treated cement in an electrically heated oven. At intervals, the beaker and contents were removed, cooled, a 40-g. sample removed, and Vinsol resin content determined.[2] Results are given in Table I.

A 1-g. sample of straight Vinsol resin in a beaker was heated under the same conditions and its loss in weight and appearance noted. At the end of 2 hr. this Vinsol resin had carbonized to a considerable extent, indicating at least some decomposition at that temperature (300 F.). Table I also shows the Vinsol resin lost in the separate sample of straight resin.

The work summarized in Table I indicates that Vinsol resin is lost from cement by heating at a temperature of 300 F. Since the decomposition noted in the resin at that temperature should certainly be suspected of changing the characteristics of the resulting product, a number of experiments were made in which Vinsol resin was heated in an oven at temperatures of 100, 200, and 300 F. for varying lengths of time up to 8 hr. This material was then ground with a mortar and pestle and added to cement by mixing in a pebble mill. The chloroform-soluble material in the cements was determined. Mortars were made from the cements and their densities determined.[3] The results were rather inconclusive. The differences caused by heating for these periods were not much greater than differences obtained on duplicate determinations using the same cement.

Vinsol resin is a material which, apparently, depends on neutralization for its air-entraining properties. The part of this reaction which produces air entrainment takes place during the brief mixing period of the mortar. Therefore, the particle size of the powdered resin used, when mixed with cement, might be expected to influence the air entrainment. At the suggestion of John Tucker, Jr., an effort was made to ascertain the magnitude of the effect of fineness. Accordingly, Vinsol resin which had a fineness, as received, of 2500 sq. cm. per g., as determined by an air-permeability apparatus,[4] was ground to a fineness of 13,000 sq. cm. per g., with a mortar and pestle. The same percentages by weight of cement of the coarse and reground Vinsol resin were mixed with separate portions of cement in a pebble mill for 1 hr. The results of determinations of chloroform-soluble material, methoxyl content of extract, and of the air content and flow of 1:3 concrete-sand mortars made with the cements are given in Table II.

Experiments Using Rotary Calciner:

The following experiments were made in an effort to simulate more closely conditions obtaining in a cement plant than was done by oven heating of intermixed Vinsol resin and cement. Two cement clinkers were ground with gypsum and Vinsol resin in a steel rotary ball mill. Grinding was continued until the specific surface (Wagner turbidimeter) was between 1900 and 2000 sq. cm. per g. Cement A contained 0.14 per cent total alkalies expressed as Na_2O, while cement B contained 0.55 per cent. Samples of each cement were then subjected to heat for definite periods of time at several different temperatures in an electrically heated rotary calciner.[5] In this way the cement was constantly rolled and mixed, although not ground, while heating was taking place. After heating, the cement was analyzed for chloroform-soluble material and the methoxyl content of the chloroform extract determined. Air content and flow were determined on mortars made from the heat-treated cements.[6, 7]

In all cases in which the heating period was less than 6 hr. at temperatures of 200, 300, and 350 F., changes produced were practically insignificant. The heating was then increased to intervals from 7 to 48 hr., at temperatures of 200, 250, and 300 F. Results of such treatment are given in Table III.

When the samples were heated at 250 F. and above, steam was observed escaping for about 3 hr. through the opening which held the thermometer.

The data in Table III indicate that above certain limits increasing the temperature and time of heating cement containing interground Vinsol resin lowers its air-entraining

[2] 1944 Book of A.S.T.M. Standards, Part II, p. 27.

[3] R. L. Blaine, "Studies of the Measurement of Specific Surface by Air Permeability," ASTM BULLETIN, No. 108, January, 1941, p. 17.

[4] The rotary cylinder used was the same equipment as described by J. A. Murray in, "Experimental Electrical Rotary Calciner," *Chemical and Metallurgical Engineering*, Nov., 1927.

[5] A.S.T.M. Tentative Method of Test for Air Content of Portland-Cement Mortar (C 185 – 44 T), 1944 Book of A.S.T.M. Standards, Part II, p. 1227.

[6] Federal Specification for Portland Cement, SS-C-158a, p. 29.

TABLE III.—EFFECT OF HEATING IN A ROTARY CALCINER ON TWO CEMENTS CONTAINING INTERGROUND VINSOL RESIN.

Heating Time, hr.	Temperature, deg. Fahr.	$CHCl_3$-Soluble Extract, per cent	CH_3O in Extract, per cent	Air in Mortar, per cent[a]	Flow, per cent
CEMENT A (0.14 PER CENT TOTAL ALKALI EXPRESSED AS Na_2O)					
Unheated	...	0.020	3.54	18.9	103
48	200	0.011	2.17	19.0	97
48	250	0.016	1.49	18.6	96
7	300	0.013	3.18	19.6	100
18	300	0.009	1.73	16.6	88
30	300	0.013	0.98	15.0	76
48	300	0.006	0.75	13.3	70
CEMENT B (0.55 PER CENT TOTAL ALKALI EXPRESSED AS Na_2O)					
Unheated	...	0.018	3.36	21.1	102
48	200	0.007	1.93	20.1	99
48	250	0.011	1.53	18.7	90
7	300	0.016	2.76	20.1	93
18	300	0.015	2.02	17.3	81
30	300	0.010	0.96	15.5	76
48	300	0.006	0.62	15.1	72

[a] Each value is the average of four determinations.

[7] Federal Specification for Portland Cement, SS-C-158a, p. 29.

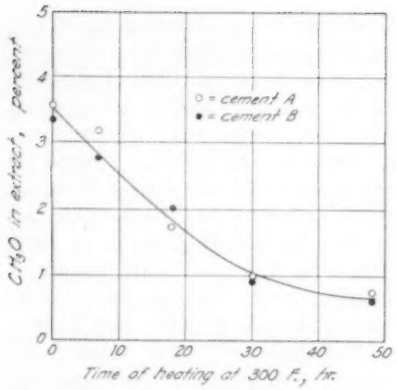

Fig. 1.—Relationship of Methoxyl Content of Chloroform Extract and Time of Heating Cement at 300 F.

properties. Cement A was unaffected by heating as long as 48 hr. at 250 F., but 18 hr. at 300 F. caused a significant reduction in air entrainment. Cement B appeared somewhat more sensitive, exhibiting a small reduction in air entrainment when heated at 250 F. for 48 hr. and a considerable reduction when heated at 300 F. for 18 hr. For each of the cements, there is a rough relationship between the air content and the CH_3O content for the 300 F. series. In general, the chloroform-soluble content and percentage of methoxyl in the extract are decreased. Figure 1 shows graphically the relationship between the percentage of methoxyl found in the chloroform extract and time of heating the cements at 300 F.

Discussion

In the manufacture of portland cement, the cement may be transferred from the ball mill to the silo with little loss of heat. Except in the case of mills having special cooling systems, the rate of cooling is very slow and frequently high temperatures may be found in the silos after many days. Experiments summarized in Tables I and III do not duplicate conditions found in a cement silo, but they do show that Vinsol resin is affected by temperatures exceeding 250 F. over extended periods of time. Furthermore they demonstrate that the air-entraining properties of cement containing the resin can be changed to a marked degree by such heat.

Several factors affecting results obtained by the methoxyl method are discussed in the paper by Bean and Peppler.[8] In using the methoxyl method, calculations are based on the assumption that the methoxyl content of the resin extracted by the chloroform-soluble method is constant (83.5 per cent recovery of 5.7 per cent CH_3O originally present in the resin before grinding and extracting). That such an assumption is not correct in the case of Vinsol resin cement which has been subjected to heating is shown clearly by the figures in Table III under the column marked "CH_3O in Extract." Figure 1 represents these values graphically and shows that the methoxyl content of the extract from heated cements is a function of the time and temperature of heating, and is not constant. Accordingly, the methoxyl method appears to be of little value as a means of measuring the amount of Vinsol resin present in cement so heated.

In correspondence with others interested in this problem it has been suggested that when cements containing Vinsol resin have been subjected to high temperatures during grinding, some of the resin may have polymerized at these temperatures to a material partially insoluble in chloroform, such cement still retaining most of its air-entraining properties. However, in Table III the data shown under the column heading "Air in Mortar" demonstrate that increased time of heating at 300 F. diminishes the air-entraining properties of the resin. It was further suggested that the polymerized resin (caused by heating) would probably be completely soluble in dichloroethylene and could thus be extracted from cement. The sample of cement A which had been heated for 48 hr. at 300 F., gave a chloroform-soluble extract of 0.006 per cent. When the same cement was extracted using dichloroethylene, 0.009 per cent of extract was obtained. The corresponding values for cement B heated 48 hr. at 300 F. were 0.006 per cent of chloroform extract and 0.011 per cent of dichloroethylene extract. This indicates that while the chloroform-soluble material in a Vinsol resin cement is considerably lowered by heating, more resin in some form is present than is indicated by the chloroform-soluble value. The results obtained by using either chloroform or dichloroethylene as a solvent indicate, however, that considerable resin is lost by prolonged heating of Vinsol resin cement at high temperatures.

[8] Leonard Bean and R. B. Peppler, "Studies of Methods for Determination of Vinsol Resin in Cement," paper being prepared.

Summary

Vinsol resin when heated in a beaker at 300 F. definitely carbonized. In 51 hr., about one-quarter of a 1-g. sample was lost by volatilization or oxidation. When cement containing interground Vinsol resin was heated at temperatures as high as 300 F. for periods as long as 48 hr., in a rotary mill, as much as two-thirds of the resin was lost as measured by the chloroform-soluble method. The methoxyl content of the residual resin was considerably reduced, and cement so treated had considerably less air-entraining properties than the same cement before heating. Dichloroethylene was found to extract more resin than did chloroform from Vinsol resin cements which had been subjected to considerable heat treatment.

Acknowledgments:

A considerable amount of the earlier work in this study was done by Milton Pollock. Julian Berch, Lillie Cook, Cyril Crocker, Richard Peppler, and Jeannette Williamson assisted in making analyses.

A Comparison of the Effect of Reference Fuels SR-6 and SR-10 with Fuel 813J and 62-Octane Gasoline on Synthetic Rubber Compounds

Report of Fluid Aging Committee[1]

THE studies described in this report were undertaken in order to determine: (*a*) how the swelling effect of two new reference fuels compared with those now in general use for testing synthetic rubber compounds, and (*b*) whether the new reference fuels would give a greater degree of reproducibility in swelling tests made in different laboratories than the fuels now used. The two reference fuels SR-6 and SR-10 were developed by the Standard Oil Development Co. for use as standard swelling media to replace fuel 813J and 62-octane gasoline. The compositions of these fuels are given in Table I.

TABLE I.—COMPOSITION OF REFERENCE FUELS.[a]

	Reference Fuel SR-6	Fuel 813J	Reference Fuel SR-10	62-Octane Gasoline
62-Octane gasoline	...	60	...	100
Di-isobutylene[b] plus inhibitor	60	...	100	...
Benzene	5	5	...	...
Toluene	20	20	...	...
Xylene	15	15	...	...

[a] Proportions by volume.
[b] Essentially pure.

Procedure:

Three synthetic rubber compounds, as described in Table II, were selected for testing. The stocks were mixed, cured, and the test specimens died out by The Ohio Rubber Co., and distributed to the following three cooperating laboratories:

The B. F. Goodrich Co.,
The Xylos Rubber Co., and
General Motors Research Laboratories.

Volume change measurements were made after ½, 1, 2, 4, 8, 16, 24, 32, 64, 128, and 168 hr. Tensile strength and elongation measurements were made after 24 and 168 hr. The immediate deteriorated properties were determined in accordance with Section 9 (*e*) of the A.S.T.M. Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids (D 471 – 43 T).[2] The procedure differed from A.S.T.M. Methods D 471 in that three test specimens were used in each test tube.

The 813J fuel was prepared by each individual laboratory and the 62-octane gasoline was procured locally by each laboratory.

Results:

The difference in the swelling effect of reference fuel SR-10 *versus* 62-octane gasoline was found to be appreciable and is probably sufficient to necessitate the revision of certain specification limits now in use where 62-octane gasoline is the immersion medium. For example, a specification which now permits no shrinkage in 62-octane gasoline should probably be revised to permit some shrinkage if reference fuel SR-10 is specified as the testing medium.

In this set of tests the reproducibility between laboratories for the reference fuels was no better than for the fuel 813J or the 62-octane gasoline. Since only three laboratories participated in this test, all of which were located in the Middle West, it is reasonable to expect that had a greater number of laboratories participated, representing a wider section geographically, an appreciable difference would have been found. This expectation is based on previous tests from laboratories in widely scattered sections of the country on identical compounds.

The agreement between laboratories for both volume increase and tensile strength and elongation tests was excellent and illustrates the reproducibility of these tests when run in accordance with A.S.T.M. standard methods.

TABLE II.—RECIPES FOR COMPOUNDS USED IN TESTS, PARTS BY WEIGHT.

	Compound A	Compound B	Compound D
Hycar OR-15	50.00	50.00	...
Perbunan 26	50.00	50.00	...
Neoprene GN	...	...	100.00
Stearic acid	0.50	0.50	0.50
Age rite resin D	5.00	5.00	...
Neozone A	...	...	2.00
Zinc oxide	5.00	5.00	5.00
Sodium acetate	...	...	1.00
Gastex	70.00	70.00	80.00
Tuads	3.00	3.00	...
Captax	1.50	1.50	...
Plasticizer SC	15.00	...	...
Tributoxy ethyl phosphate	...	...	10.00
Permalux	...	...	0.30
Cure	25 min. at 307 F.	25 min. at 307 F.	15 min. at 307 F.

Conclusions:

1. Reference fuel SR-6 gave results which were for all practical purposes identical with those obtained from fuel 813J (see Fig. 1 and Table III).
2. Reference fuel SR-10 gave an appreciably lower swell and a correspondingly lower drop in tensile strength than 62-octane gasoline (see Fig. 2 and Table IV).
3. The reproducibility between laboratories for both the volume change tests and tensile strength

NOTE.—DISCUSSION OF THIS REPORT IS INVITED, either for publication or for the attention of the committee. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] A committee of Subsection IV on Classification and Specifications for Rubber Compounds, of Technical Committee A on Automotive Rubber, which functions under the joint auspices of the A.S.T.M. and the Society of Automotive Engineers. The personnel of the committee comprises W. D. Parrish, chairman, A. J. Kearfott, S. W. McCune, R. H. Crossley, A. E. Juve, E. N. Cunningham, Merle Sanger, and J. F. McWhorter.

[2] 1943 Supplement to Book of A.S.T.M. Standards, Part III, p. 405.

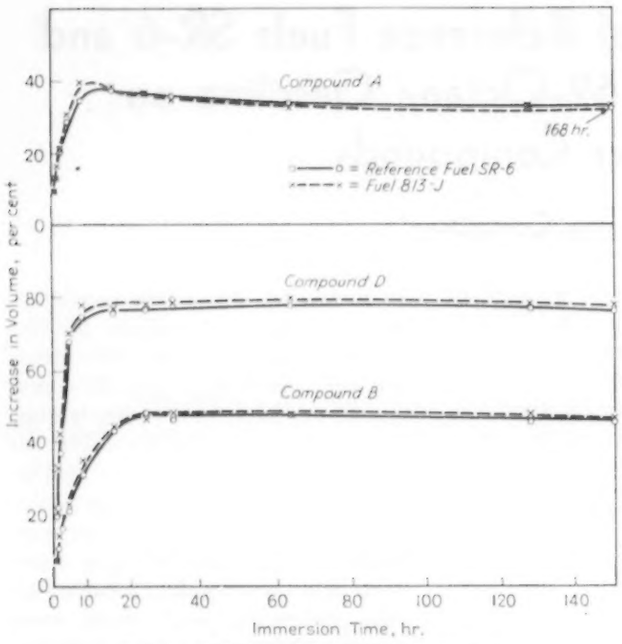

Fig. 1.—Relation of Increase in Volume to Immersion Time with Reference Fuel SR-6 and with Fuel 813J.
Average Results from Three Laboratories.

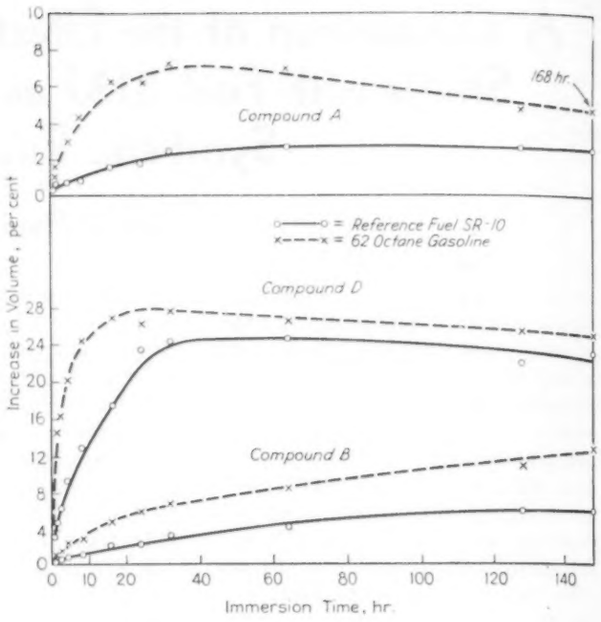

Fig. 2.—Relation of Increase in Volume to Immersion Time with Reference Fuel SR-10 and with 62-Octane Gasoline.
Average Results from Three Laboratories.

TABLE III.—COMPARISON OF RESULTS OBTAINED WITH REFERENCE FUEL SR-6 AND WITH FUEL 813J.

AVERAGE RESULTS FROM THREE LABORATORIES.

	Compound A		Compound B		Compound D	
	Tensile Strength, psi.	Elongation, per cent	Tensile Strength, psi.	Elongation, per cent	Tensile Strength, psi.	Elongation, per cent
Original	2194	670	2792	555	2495	255
24 hr. in reference fuel SR-6	755	325	953	278	900	120
24 hr. in fuel 813J	757	330	838	258	845	120
168 hr. in reference fuel SR-6	762	327	942	293	855	110
168 hr. in fuel 813J	780	330	927	278	795	110

TABLE IV.—COMPARISON OF RESULTS OBTAINED WITH REFERENCE FUEL SR-10 AND WITH 62-OCTANE GASOLINE.

AVERAGE RESULTS FROM THREE LABORATORIES.

	Compound A		Compound B		Compound D	
	Tensile Strength, psi.	Elongation, per cent	Tensile Strength, psi.	Elongation, per cent	Tensile Strength, psi.	Elongation, per cent
Original	2194	670	2792	555	2495	255
24 hr. in reference fuel SR-10	1840	562	2423	525	1610	170
24 hr. in 62-octane gasoline	1595	528	2313	473	1640	175
168 hr. in reference fuel SR-10	1850	582	2240	518	1810	175
168 hr. in 62-octane gasoline	1658	552	1920	472	1770	180

TABLE V.—DEVIATIONS AMONG LABORATORIES.

	Reference Fuel SR-6			Fuel 813J			Reference Fuel SR-10			62-Octane Gasoline		
Compound...	*A*	*B*	*D*	*A*	*B*	*D*	*A*	*B*	*D*	*A*	*B*	*D*
VOLUME CHANGE, AVERAGE DEVIATION, PER CENT												
24 hr.	0.94	1.93	1.55	0.72	0.83	0.31	0.41	0.44	1.06	0.67	1.22	3.6
168 hr.	0.17	0.9	1.6	0.97	1.2	0.62	0.85	0.11	2.24	0.11	1.9	2.9
TENSILE STRENGTH, AVERAGE DEVIATION, PSI.												
Original	4.8	103	40	4.8	103	40	4.8	103	40	4.8	103	40
24 hr.	63	58	6.3	28	51	64	142	85	122	100	270	120
168 hr.	93	67	48	33	30	106	237	173	153	152	145	152
ELONGATION, AVERAGE DEVIATION, PER CENT												
Original	50	30	31	50	30	31	50	30	31	50	30	31
24 hr.	23	17.5	11	22.8	9.1	6.9	53.2	23.1	4.1	30.6	28	8.9
168 hr.	8.8	5.8	2.0	6.9	13.9	7.0	9.3	35.8	11.9	18.8	58.7	11.9

and elongation change tests was excellent for both reference fuels, but not significantly better for the reference fuels than for fuel 813J or 62-octane gasoline (see Table V).

Recommendation:

This committee recommends that reference fuels SR-6 and SR-10 be used as immersion media for specification purposes in place of the fuels now used[3] with the proviso that adjustments in specification limits for reference fuel SR-10 be made in those cases where it appears to be necessary.

[3] This recommendation resulted in the revision of the A.S.T.M. Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids (D 471 – 44 T), to include the reference fuels, see 1944 Book of A.S.T.M. Standards, Part III, p. 1787.

A Simplified Method for the Determination of the Specific Gravity of Wood and Plastics

By E. George Stern[1] and Paul S. Dear[1]

SYNOPSIS

Using a mercury-balance volumeter, a suggested method is given for simplifying the recommended A.S.T.M. methods for determination of the specific gravity of wood and of solid plastics. Comparison is made of test data for yellow poplar and Tenite, obtained according to the various methods employed.

The following advantages were found:

1. The mercury-balance method gives as accurate data for small 2 by 2 by ½-in. test specimens as the A.S.T.M. Standard Method for Wood requiring 2 by 2 by 6-in. test specimens.
2. Small-size samples cut from undestroyed parts of specimens previously tested for physical and mechanical properties can be used.
3. Rough, unfinished specimens of any shape can be used.
4. Covering of wooden specimens with a wax film before immersion of the specimens in water, as required by the A.S.T.M. method for wood, is unnecessary.
5. Immersion of the specimens in water, as required by the A.S.T.M. method for plastics is eliminated; thus, swelling of specimens cannot occur.

IN DETERMINING specific gravity in accordance with the A.S.T.M. Standard Methods for Testing Small Clear Specimens of Timber (D 143 – 27),[2] 2 by 2 by 6-in. specimens, must be (1) oven dried at 100 C. until constant weight is reached, (2) weighed, (3) immersed while still warm in hot paraffin for the application of a thin coating, and (4) their volumes determined by immersion in water and weighing of their displacement of water.

The A.S.T.M. Tentative Methods of Testing Veneer, Plywood, and Other Wood, and Wood-Base Materials (D 805 – 44 T)[3] allow determination of the specific gravity by calculation of volumes according to dimensions or according to the water-immersion method.

The A.S.T.M. Tentative Methods of Test for Specific Gravity of Plastics (D 792 – 44 T)[4] recommend, in method A for plastics in finished condition, observation of displacement of a like volume of freshly boiled distilled water for plastics which are unaffected by water and of kerosene or other suitable liquids for other plastics. No specific specimen size is recommended.

The displacement method for the determination of the specific gravity of wood calls for the specimen to be rigidly suspended from a fixed prong and the direct weighing of its volume in water. The corresponding method for plastics calls for the specimen to be freely suspended from the balance lever and for the simultaneous weighing of both volume and weight when immersed in water.

An improved mercury-balance volumeter was developed during a study of clays.[5] The purpose of this paper is to indicate the advantages of such a mercury-balance volumeter for the determination of the specific gravity of wood and solid plastics.

The mercury-balance volumeter was built in the machine shops of the Virginia Polytechnic Institute. The tests were performed in its Wood Research Laboratory under the auspices of the Virginia Polytechnic Institute Research Foundation, Inc. Acknowledgment is made to Miss Phyllis L. Thrasher, laboratory assistant of the Wood Research Laboratory, for her assistance in the performance of the tests.

DESCRIPTION OF INVESTIGATION

Equipment:

For tests on the specific gravity of 2 by 2 by 6-in. wood specimens according to the A.S.T.M. Methods D 143 a Harvard trip scale with two graduated beams reading 0.1 to 200 g. was used as shown in Fig. 1. For tests on 2 by 2 by ½-in. wood and ⅝ by ⅝ by 2-in. plastic specimens a triple beam balance with three graduated beams reading 0.01 to 100 g., as shown in Fig. 2, and a double-beam balance (metric solution balance) with a 1-g. sensitivity and a 20-kg. capacity, shown in Fig. 3, were employed.

The mercury-balance volumeter used consisted of (1) a mercury container holding approximately 15 lb. of mercury, and (2) the double-beam balance equipped with a special saddle at the head of the beam vertically guiding a thin steel rod with attached specimen holder. The test setup is shown in Fig. 3.

An electric drying oven with a constant temperature of 100 C. was used for drying the wood samples to constant weight.

Micrometers indicating 0.001 in. were used for dimensioning the specimens.

Test Material:

To obtain typical comparative data on the various testing procedures employed, representative materials of uniform textures and free from growth or molding irregularities were selected. The yellow poplar was second-growth, sound wood from a single stick cut from a tree with an average specific gravity of 0.43 and grown in Tazewell County,

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Research Engineers, Virginia Polytechnic Institute, Blacksburg, Va.

[2] 1944 Book of A.S.T.M. Standards, Part II, p. 730.

[3] *Ibid.*, p. 1453.

[4] 1944 Book of A.S.T.M. Standards, Part III p. 1672.

[5] S. Speil and H. Wilson, "An Improved Mercury-Balance Volumeter," *Journal of The Am. Ceramic Soc.*, Vol. 25, No. 10, pp. 275–277 (1942).

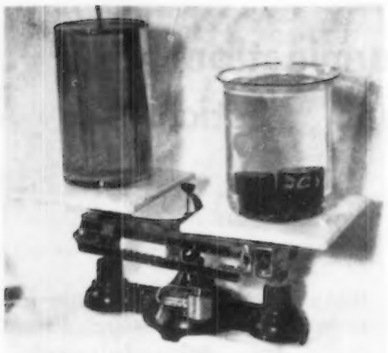

Fig. 1.—Test Setup for 2 by 2 by 6-in. Specimens According to A.S.T.M. Methods for the Determination of the Specific Gravity of Wood.

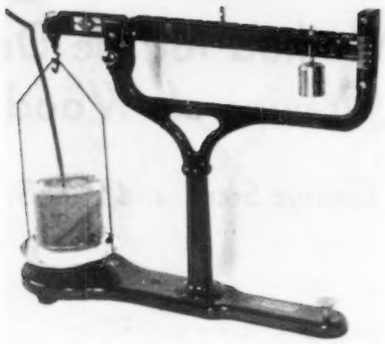

Fig. 2.—Test Setup for 2 by 2 by ½-in. Specimens Similar to A.S.T.M. Methods for the Determination of the Specific Gravity of Wood and Plastics.

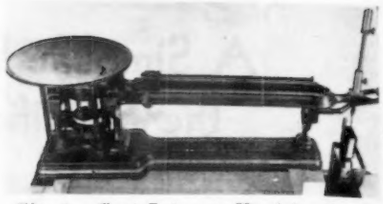

Fig. 3.—Test Setup as Used for the Suggested Method of Determination of the Specific Gravity of Wood and Plastics.

Va. The Tenite specimens were cut and machined in pairs from specimens sawn from the same lot of ⅛-in. molded and polished panels of an average specific gravity of 1.19, manufactured by the Tennessee Eastman Corp.

Test Performance:

The planed and sanded 2 by 2-in. yellow-poplar stick was sawn into five 2 by 2 by 6-in. specimens, the ends of which were sanded. These specimens were dried, dimensioned, and weighed. Two alternate blocks were dipped into hot paraffin wax and their volumes determined by weighing them supported and immersed in water. Each of the three remaining alternate blocks was sawn into nine 2 by 2 by ½-in. specimens, with five alternate specimens sanded at their ends. The specimens were dimensioned, weighed in air, weighed immersed in mercury, and —after being dipped in hot paraffin wax—weighed supported and immersed in water.

The plastic test specimens were milled at two sides and both ends, with the remaining two sides left factory polished. The ⅝ by ⅝ by 2-in. specimens were conditioned at 77 F. and 47 per cent relative humidity, dimensioned, weighed in air, weighed immersed in mercury, and weighed supported and immersed in water.

For the determination of the volume by the water-immersion

TABLE I.—COMPARATIVE TEST DATA FOR THE DETERMINATION OF THE SPECIFIC GRAVITY OF YELLOW POPLAR.

Test Sign	Specimen Size, in.	Condition of Ends	Specific Gravity According to			Specific Gravity, per cent of Average According to			Specific Gravity, per cent of 0.435 According to		
			Dimensions	Mercury Immersion	Water Immersion	Dimensions	Mercury Immersion	Water Immersion	Dimensions	Mercury Immersion	Water Immersion
A	2 by 2 by 6	Sanded	0.434	.....	.....	100.0	.....	.....	99.8	.....	.....
B			0.434	.....	0.437	100.0	.....	99.9	99.8	.....	100.5
C			0.435	.....	.....	100.2	.....	.....	100.0	.....	.....
D			0.436	.....	0.438	100.5	.....	100.1	100.2	.....	100.7
E			0.432	.....	.....	99.5	.....	.....	99.3	.....	.....
Avg			0.434	.....	0.4375	100.0	.....	100.0	99.8	.....	100.6
A-1	2 by 2 by ½	Sanded	0.437	0.436	0.448	100.0	100.0	100.9	100.5	100.2	103.0
A-3			0.437	0.437	0.446	100.0	100.2	100.5	100.5	100.5	102.5
A-5			0.442	0.442	0.447	101.1	101.4	100.7	101.6	101.6	102.8
A-7			0.438	0.436	0.442	100.2	100.0	99.5	100.7	100.2	101.6
A-9			0.431	0.431	0.437	98.6	98.9	98.4	99.1	99.1	100.5
Avg			0.437	0.436	0.444	100.0	100.0	100.0	100.5	100.2	102.1
A-2	2 by 2 by ½	Sawn	0.432	0.428	0.433	98.6	98.4	98.0	99.3	98.4	99.5
A-4			0.442	0.440	0.449	100.9	101.1	101.6	101.6	101.1	103.2
A-6			0.442	0.439	0.446	100.9	100.9	100.9	101.6	100.9	102.5
A-8			0.438	0.434	0.440	100.0	99.8	99.5	100.7	99.8	101.1
Avg			0.438	0.435	0.442	100.0	100.0	100.0	100.7	100.0	101.6
Grand avg.		Sanded and Sawn	0.438	0.436	0.443	...	...	...	100.7	100.2	101.8
C-1	2 by 2 by ½	Sanded	0.446	0.445	0.453	102.8	102.1	102.5	102.5	102.3	104.1
C-3			0.439	0.440	0.444	101.2	100.9	100.5	100.9	101.1	102.1
C-5			0.429	0.433	0.439	98.8	99.3	99.3	98.6	99.5	100.9
C-7			0.425	0.428	0.436	97.9	98.2	98.6	97.7	98.4	100.2
C-9			0.433	0.434	0.440	99.8	99.5	99.5	99.5	99.8	101.1
Avg			0.434	0.436	0.442	100.0	100.0	100.0	99.8	100.2	101.6
C-2	2 by 2 by ½	Sawn	0.451	0.442	0.449	103.7	102.3	102.5	103.7	101.6	103.2
C-4			0.432	0.433	0.439	99.3	100.2	100.2	99.3	99.5	100.9
C-6			0.429	0.426	0.429	98.6	98.6	97.9	98.6	97.9	98.6
C-8			0.427	0.425	0.434	98.2	98.4	99.1	98.2	97.7	99.8
Avg			0.435	0.432	0.438	100.0	100.0	100.0	100.0	99.3	100.7
Grand avg.		Sanded and Sawn	0.435	0.434	0.440	...	...	...	100.0	99.8	101.1
E-1	2 by 2 by ½	Sanded	0.440	0.437	0.442	101.1	100.7	100.9	101.1	100.5	101.6
E-3			0.433	0.432	0.438	99.5	99.5	100.0	99.5	99.3	100.7
E-5			0.428	0.429	0.433	98.4	98.8	98.9	98.4	98.6	99.5
E-7			0.435	0.435	0.440	100.0	100.2	100.5	100.0	100.0	101.1
E-9			0.438	0.435	0.439	100.7	100.2	100.2	100.7	100.0	100.9
Avg			0.435	0.434	0.438	100.0	100.0	100.0	100.0	99.8	100.7
E-2	2 by 2 by ½	Sawn	0.437	0.437	0.443	100.5	100.7	101.1	100.5	100.5	101.8
E-4			0.429	0.428	0.430	98.6	98.6	98.2	98.6	98.4	98.9
E-6			0.442	0.441	0.445	101.6	101.6	101.6	101.6	101.4	102.3
E-8			0.431	0.429	0.433	99.1	98.8	98.9	99.1	98.6	99.5
Avg			0.435	0.434	0.438	100.0	100.0	100.0	100.0	99.8	100.7
Grand avg.		Sanded and Sawn	0.435	0.434	0.438	...	...	...	100.0	99.8	100.7
Grand avg.		Sanded	0.435	0.435	0.442	...	...	...	100.0	100.0	101.6
Grand avg.		Sawn	0.436	0.434	0.439	...	...	...	100.2	99.8	100.9
Grand avg.		Sanded and Sawn	0.436	0.435	0.441	...	...	...	100.2	100.0	101.4

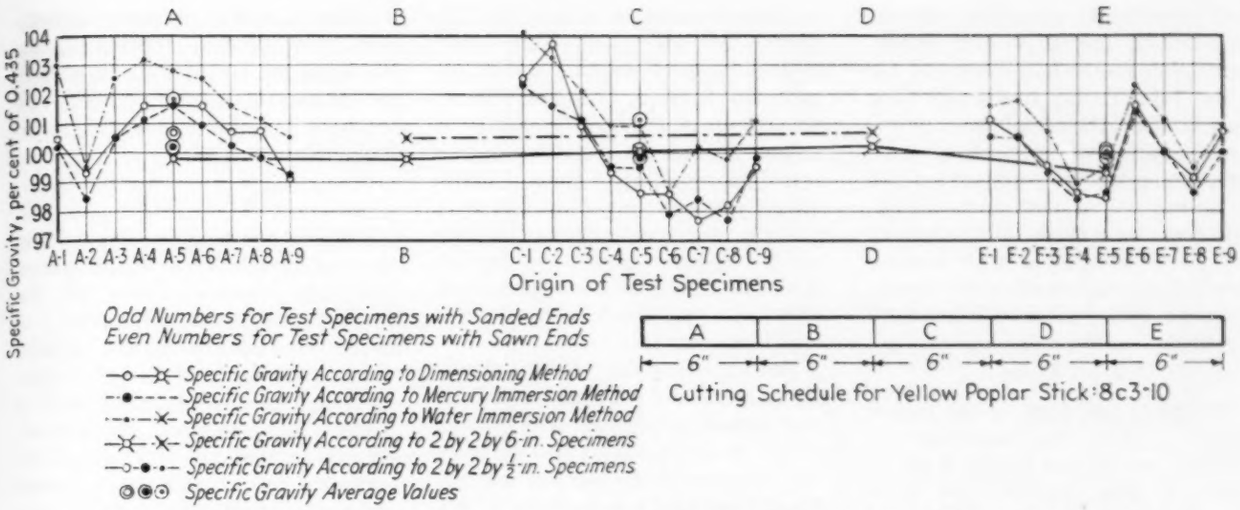

Fig. 4.—Influence of Origin of Test Specimens on Specific Gravity Values for Yellow Poplar Stick 8c3-10.

TABLE II.—COMPARATIVE TEST DATA FOR THE DETERMINATION OF THE SPECIFIC GRAVITY OF TENITE.

Test Sign	Specific Gravity According to			Specific Gravity, in Per Cent of Average According to		
	Dimensions	Mercury Immersion	Water Immersion	Dimensions	Mercury Immersion	Water Immersion
4-1	1.181	1.178	...	99.9	99.8	...
4-2	1.184	1.176	...	100.2	99.7	...
5-1	1.187	1.181	...	100.4	100.1	...
5-2	1.179	1.183	...	99.75	100.25	...
7-1	1.180	1.183	...	99.8	100.25	...
7-2	1.180	1.179	...	99.8	99.9	...
Avg.	1.182	1.180	...	100.0	100.0	...
4-1	1.182	1.185	1.183	100.8	99.7	99.7
4-2	1.179	1.189	1.182	100.5	100.1	99.7
5-1	1.173	1.189	1.185	100.0	100.1	99.9
5-2	1.168	1.186	1.185	99.6	99.8	99.9
7-1	1.168	1.190	1.188	99.6	100.2	100.2
7-2	1.168	1.187	1.190	99.6	99.9	100.3
Avg.	1.173	1.188	1.186	100.0	100.0	100.0
0-1	1.191	1.181	1.200	99.9	100.1	100.5
0-2	1.188	1.176	1.192	99.7	99.7	99.8
1-1	(1.236)[a]	(1.180)[a]	(1.191)[a]	(103.7)[a]	(100.0)[a]	(99.7)[a]
1-2	1.190	1.180	1.190	99.8	100.0	99.7
3-1	1.191	1.182	1.191	99.9	100.2	99.7
3-2	1.199	1.182	1.199	100.6	100.2	100.4
Avg.	1.192	1.180	1.194	100.0	100.0	100.0
Grand avg.	1.182	1.183	1.190	...	...	...

[a] These data were not used for comparison because of evident experimental error in obtaining a specific gravity value of 1.236.

TABLE III.—SUMMARY AVERAGE SPECIFIC GRAVITY DATA WITH MINIMUM AND MAXIMUM TEST VALUES.

Test Specimen and Test Method	Number Tested	Average Specific Gravity	Specific Gravity		
			Minimum	Maximum	Range
Yellow Poplar					
2 by 2 by 6-in. Specimen					
Dimensioning	5	0.434	0.432	0.436	0.004
Dimensioning	2	0.435	0.434	0.436	0.002
Water Immersion	2	0.4375	0.437	0.438	0.001
2 by 2 by ½-in. Specimen	(total)				
Dimensioning	27	0.436	0.425	0.451	0.026
Mercury Immersion	27	0.435	0.425	0.445	0.020
Water Immersion	27	0.441	0.429	0.453	0.024
2 by 2 by ½-in. Specimen	(sawn)				
Dimensioning	12	0.436	0.427	0.451	0.024
Mercury Immersion	12	0.434	0.425	0.442	0.017
Water Immersion	12	0.439	0.429	0.449	0.020
2 by 2 by ½-in. Specimen	(sanded)				
Dimensioning	15	0.435	0.425	0.446	0.021
Mercury Immersion	15	0.435	0.428	0.445	0.017
Water Immersion	15	0.442	0.433	0.453	0.020
Tenite					
⅝ by ⅝ by 2-in. Specimen					
Dimensioning	12	1.182	1.168	1.199	0.031
Mercury Immersion	12	1.183	1.176	1.190	0.014
Water Immersion	12	1.190	1.182	1.200	0.018

method, the test specimens were suspended from a $\frac{3}{16}$-in. diameter steel rod, with end tapered in order to minimize any increase in weighed volume resulting from immersion of the end of this rod into the water bath.

For the determination of the volume of all test specimens with the mercury-balance volumeter, the specimen container was lowered into the mercury bath with its descent limited by a stop fastened to the ¼-in. diameter rod. The small rod diameter eliminated a possible source of error caused by the rise of the mercury level upon insertion of the specimen holder with the test sample. The calibration of the mercury-balance volumeter[5] used for the study called for the computation of the volume of the test specimen as indicated below:

$$V = 0.0739W_{\text{in air}} + 0.0168W_{\text{in merc.}}$$

where:

$W_{\text{in air}}$ = the weight of the test sample in air, and

$W_{\text{in merc.}}$ = the weight of the test sample immersed in mercury.

A nomographic chart drawn up for the volumeter in use could have been employed to advantage to allow immediate determination of the volume without computations for every test observation.[5]

Some of the plastic specimens were tested a second time and some of the data for tests on yellow poplar were observed four times in order to determine the accuracy of replication of the various test methods employed.

Number of Tests:

Two A.S.T.M. Standard tests on yellow poplar made possible comparison of standard data with data obtained from 27 matched 2 by 2 by

6-in. specimens according to dimensioning, mercury- and water-immersion methods. Twelve $\frac{5}{8}$ by $\frac{5}{8}$ by 2-in. Tenite specimens were tested with their volumes determined successively according to dimensioning, mercury-immersion and water-immersion methods. Duplicate tests were made on one half of the plastic specimens with volume determinations according to dimensioning and mercury-immersion methods.

Test Data

Complete test data for the yellow poplar samples are tabulated in Table I and plotted in Fig. 4 which indicates the influence of local growth variations of the yellow poplar specimens on the specific gravity values. Detailed test data for the Tenite specimens are given in Table II. Summary average specific gravity data with minimum and maximum test values are shown in Table III.

Statistical Analysis of Test Data

A statistical analysis of variance was made of the test data reported to three decimal places. The summary of results is presented in Table IV.

Replications.—Preliminary repeat tests ascertained that replications did not yield significantly different specific gravity values at the 5 and 1 per cent levels[6] for standard and smaller-than-standard yellow poplar and for Tenite specimens, tested with the various methods as shown in Table IV. Hence, all three test methods employed are capable of a comparatively high order of precision.

Specimens.—From Table IV it is evident that the variance of specific gravity values for the standard 2 by 2 by 6-in. yellow poplar blocks cut from the same stick and for individual 2 by 2 by $\frac{1}{2}$-in. yellow poplar specimens cut from a single block is of highest order of magnitude, although all specimens were sawn from a selected, sound stick of apparently uniform texture. Thus, for all tests on the specific gravity of yellow poplar, the variance of the test data reported to three decimal places was highly significant at the 5 and 1 per cent levels. Tenite yielded specific gravity values for the individual specimens with variances not significant both at the 5 and 1 per cent levels.

Sanded versus Sawn Ends.—Sanding as compared with sawing of ends was found significant, that is, one tenth as significant as the variance due to origin of the specimens at the 5 and 1 per cent levels for the 2 by 2 by 6-in. specimens of the preliminary test series. It also proved to be significant for a few of the 2 by 2 by $\frac{1}{2}$-in. specimens, while the variance for the specific gravity values of the other 2 by 2 by $\frac{1}{2}$-in. specimens was not significant at both levels.

Test Methods.—The variance of specific gravity values for yellow poplar specimens was found to be significant for the three test methods employed at the 5 and 1 per cent levels, except between the dimension and mercury-immersion methods. For Tenite specimens, the variance was not significant at both levels except for a border-line case between the dimension and water-immersion methods.

Conclusions

While the statistical analysis of the test data makes available mathematically correct results for the specific gravity values reported to three decimal places, any conclusions made in interpreting these statistical data should be confined to those of practical significance. Wood is a nonhomogeneous material with numerous growth characteristics and irregularities which influence its specific gravity. Thus, the probable variation of the specific gravity of a random tree from the average for the species is approximately 4 per cent,[7] while, for example, the greatest observed difference in average specific gravity between four to six individual redwood trees from a single locality was as much as 25 per cent, based on the

[6] Significance is used in the mathematical sense to answer the question as to whether an observed difference in means is large enough so that it would be unreasonable to conclude that no actual difference exists in the populations of measurements sampled. In this paper, "significant" is used for any deviation (or difference) for which the probability (or level) of a greater deviation is 5 per cent; and "highly significant" is used for any deviation for which this probability is 1 per cent or less. Each suspected cause of variance was tested against the error mean square to determine the value of the ratio F. This ratio was compared with the values of F appearing in Tables of Snedecor for the 5 per cent and 1 per cent significant levels. Where values are missing, a T-test was used.

[7] L. J. Markwardt and T. R. C. Wilson, "Strength and Related Properties of Woods Grown in the United States," 1935, U. S. Dept. of Agri. Tech. Bull. No. 479, pp. 40–42.

TABLE IV.—ANALYSIS OF VARIANCE OF SPECIFIC GRAVITY VALUES FOR YELLOW POPLAR AND TENITE SPECIMENS.

Test Methods I—According to dimensions.
II—According to mercury immersion.
III—According to water immersion.

Test Material	Test No.	Specimen Size, in.	Source of Variation	Degrees of Freedom	Mean Square	Significant at 5 per cent Level	Significant at 1 per cent Level
Yellow Poplar (Preliminary Tests)	1–16	2 by 2 by 6	Replications	3	0.9	...	...
			Specimens	2	182.8	X	X
			Treatment[a]	1	18.0	X	X
			Methods I, III	1	28.1	X	X
			Error	24	0.7	...	...
Yellow Poplar (Preliminary Tests)[b]	21–52	2 by 2 by ½	Replications	3	72.0	...	...
			Specimens	7	1337.2	X	X
			Methods I, II, III	2	877.0	X	X
			Methods I, II	...	...	X	...
			Methods I, III	...	...	X	X
			Methods II, III	...	...	X	X
			Error	83	29.8	...	...
Yellow Poplar	105–136	2 by 2 by ½	Blocks A, C, E	2	84.1	X	X
			Specimens of Block A	8	60.1	X	X
			Specimens of Block C	8	173.2	X	X
			Specimens of Block E	8	67.4	X	X
			Treatment,[a] Block A	...	...	...	...
			Treatment,[a] Block C	...	...	X	X
			Treatment,[a] Block E	...	...	...	...
			Methods I, II, III	2	273.9	X	X
			Methods I, II	...	...	...	...
			Methods I, III	...	...	X	X
			Methods II, III	...	...	X	X
			Error	52	3.7	...	...
Tenite	87–98	5/8 by 5/8 by 2	Replications	1	2.0	...	...
			Specimens	5	10.8	...	...
			Methods I, II	1	247.0	...	...
			Error	16	56.2	...	...
Tenite	93–104	5/8 by 5/8 by 2	Specimens	10	52.4	...	...
			Methods I, II, III	2	181.9	...	...
			Methods I, II	...	...	...	...
			Methods I, III	...	...	X	...
			Methods, II, III	...	...	...	...
			Error	20	62.5	...	...

[a] Sanded *versus* sawn ends.
[b] All specimen sides wax covered as cut from block A (test Nos. 1–4).

heaviest tree;[7] the greatest difference between 57 individual redwood trees from 12 different localities was 30 per cent;[7] the variation within a cross section of a redwood tree was reported as much as 50 to 60 per cent;[7] the reported variation within the yellow poplar tree from which the yellow poplar test stick was sawn was found to be as much as 25 per cent.[8] Hence, statistically significant differences of individual specific gravity test values for wood reported to three decimal places may be practically insignificant because of the nonhomogeneity of the material, even if selected for uniformity in texture and for absence of growth irregularities.

According to the test data presented, the maximum variation of the individual specific gravity values for the 2 by 2 by ½-in. specimens with sanded ends cut from the same yellow poplar stick was 4.7 per cent according to the method of dimensions, 3.8 per cent according to the method of mercury immersion, and 4.4 per cent according to the method of water immersion. Hence, even specific gravity data reported to two decimal places only, showed statistically significant variations based on natural variations of specific gravity within the selected yellow poplar stick.

For homogeneous materials, however, such as certain plastics, the variance for specific gravity values among matched specimens was found not significant, even if reported to three decimal places. Hence, any variations of the test data within three decimal places may be of practical significance. Such data may be justifiably reported, provided the test procedure employed is sensitive enough to yield precise data.

In comparing the variances within the testing procedures used, the report of data to three decimal places was necessary because of the comparatively high order of precision of all three test methods. As replications for the three test procedures did not yield significantly different specific gravity values even at the 1 per cent level of significance, all these three methods can be considered satisfactory from the viewpoint of precision. The data obtained by the mercury-immersion method, however, show the smallest range of variation in all tests conducted.

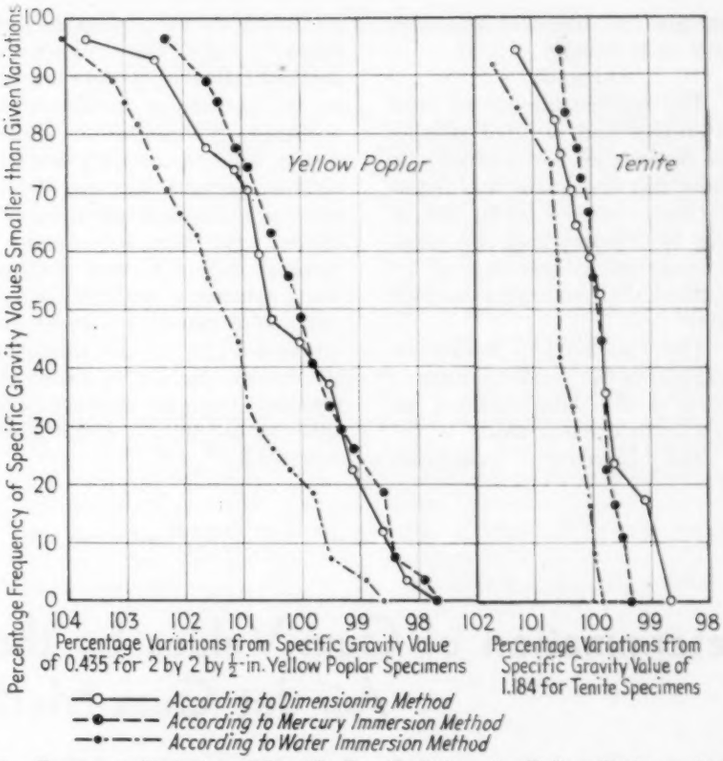

Fig. 5.—Frequency Variation of Specific Gravity Values for Yellow Poplar and Tenite.

A comparison of the yellow poplar test data obtained according to the various testing procedures employed indicates according to Table IV most outstanding significant variances between data according to the dimension and water-immersion methods and the mercury-immersion and water-immersion methods. The variations in the level of the data for the three test methods are shown graphically in Figs. 4 and 5. The average differences in level of data for 2 by 2 by ½-in. specimens according to the water-immersion method from those according to the methods of dimensions and mercury immersion were found to be less than 1.1 and 1.4 per cent, respectively. Thus, it may be concluded that the statistically significant variance for the individual test methods is practically insignificant because of the possible high order of precision shown for all the three test methods employed.

For the plastic specimens, the variance for the three test methods was found not significant, with the variations in the mean test results according to dimension and mercury-immersion test methods from those according to the water-immersion method less than 0.7 and 0.6 per cent, respectively.

Sanding of the ends of the yellow poplar test specimens, although found statistically significant for some of the test data, was practically insignificant, as evidenced in Fig. 4 according to all the three test methods used.

The 2 by 2 by ½-in. yellow poplar test specimen yielded average specific gravity values of practically insignificant differences from those obtained for the 2 by 2 by 6-in. A.S.T.M. standard specimens from the same stick. The A.S.T.M. standard specimen gives an average specific gravity value for a relatively large block. Smaller test specimens may yield reliable data representative only for the particular small samples because of the possible variation of the specific gravity in wood. Thus, when smaller than A.S.T.M. standard test specimens are used for the determination of specific gravity of wood—often only small-size specimens may be available—a larger number of samples might be tested and the results averaged to obtain representative

[8] E. G. Stern, "Strength Properties of Yellow Poplar from Virginia," 1944, Va. Poly. Inst. Eng. Exp. Station Series No. 59.

specific gravity values for a wooden member or structure.

SUMMARY

1. The specific gravity of most wood species and of solid plastics can be determined satisfactorily by weighing test specimens and determining their volumes (*a*) by dimensioning, (*b*) by weighing the specimens immersed in mercury, or (*c*) by weighing their volumes immersed in water.

2. The mercury - immersion method shows the smallest range of variation in the data obtained according to the three methods.

3. The mercury - immersion method is the most practical one because: (*a*) the dimensioning method calls for accurate machining of the specimens to obtain satisfactorily representative measurements, while the mercury-immersion method permits the use of rough, uneven, unfinished specimens of any shape; (*b*) the water-immersion method calls for wax coating of wood specimens and may result in swelling of plastic specimens during immersion; (*c*) the determination of the specific gravity by means of the mercury-immersion method is faster than by any of the other methods described.

4. Small-size test specimens can yield as accurate data on the specific gravity of wood as the larger 2 by 2 by 6-in. A.S.T.M. standard specimens.

5. The mercury - immersion method, however, may not be satisfactory for the determination of the specific gravity of porous plastics and such porous woods as balsa and some of the oaks with extremely large ducts or vessels along the grain, into which the mercury might penetrate. The resulting increase in the specific gravity values may, however, be negligible if large enough test specimens are used.

Determination of Gum Values by the I.P.T. and A.S.T.M. Air Jet Gum Methods

By E. L. Walters[1] and D. L. Yabroff[1]

GUM contents of gasoline determined by so-called air jet evaporation methods have been reported[2] to vary due to variable test conditions, that is, evaporation temperature and rates of air flow. Two so-called "air jet" gum methods, the A.S.T.M. and I.P.T. (Institution of Petroleum Technologists) methods, are used widely here and abroad. Differences in gum measurements by these methods, indeterminable from available information, have now been related empirically, thus increasing the universal significance of gum stability measurements made in different laboratories by means of one or the other gum method.

In order to interrelate gum measurements made by either test method, sufficient experimental data were obtained to determine with reasonable accuracy the average ratio of gum values and gum times by the two methods for a number of gasolines.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Shell Development Co., Emeryville, Calif.

[2] G. Egloff, J. C. Morrell, C. Wirth, and G. B. Murphy, "Significance of Test Methods for Gum in Gasoline," *Proceedings*, World Petroleum Congress, Vol. II, p. 85 (1933).

EXPERIMENTAL METHODS

A.S.T.M. gum determinations were carried out in accordance with the Standard Method of Test for Gum Content of Gasoline (D 381 – 44).[3] Both the evaporation temperature and air flow rates are higher for this method than for the I.P.T. method. I.P.T. gums were carried out essentially in accordance with the method for Gum (Existant) in Motor Fuel, etc., I.P.-38/44(T),[4] incorporating certain slight modifications to improve the utility and accuracy of the test method without, however, sensibly affecting the gum values obtained by the method. The modifications introduced into the I.P.T. method were as follows:

1. For convenience, simplification, and closer comparability with the A.S.T.M. method, only one sample size (50 ml.) was used throughout, irrespective of the gum content of the gasoline. The test specifications require the use of a smaller sample size (25 ml.) for samples whose gum contents are in excess of 20 mg. per 100 ml.

[3] 1944 Book of A.S.T.M. Standards, Part III, p. 191.

[4] *Standard Methods for Testing Petroleum and Its Products*, Institute of Petroleum, Sixth Edition, 1945, p. 171.

2. To increase the precision of weighing, samples were allowed to equilibrate in desiccators (free of any desiccant material) for at least 1 hr. after drying and prior to weighing.

It was found, in addition, that variations in equipment within the limits specified by the I.P.T. method could, in certain cases, slightly affect the test results. For example, it was noted that the use of different types of steam evaporation baths (conventional boiling water type bath or special enclosed copper dish type steam bath) resulted in the obtaining of slightly different I.P.T. gum values. Thus evaporation on a specially constructed steam bath[5] for determining copper dish gums gives slightly lower (approximately 5 per cent) I.P.T. gum values than those listed in this paper. The I.P.T. gum values listed in this paper, however, refer to values obtained on a conventional laboratory rectangular baffle plated steam bath and should be closely comparable to data obtained on refinery equipment.

Considerable latitude is also allowed in the specifications for the

[5] Bureau of Mines Report of Investigation No. 3152, November, 1931.

TABLE I.—PRELIMINARY CORRELATION DATA SHOWING THE RATIO OF I.P.T. AND A.S.T.M. GUMS FOR CRACKED GASOLINES.

Gasoline	I.P.T. Gum, mg. per 100 ml.		A.S.T.M. Gum, mg. per 100 ml.		Ratio of Average Values, I.P.T./A.S.T.M.
	Individual Values	Average Values	Individual Values	Average Values	
Partially aged samples of full range thermal cracked gasoline; different samples	3.4, 3.4, 2.8, 2.6, 3.6, 3.2, 3.2, 2.6	3.1	2.2, 2.4	2.3	1.35
	3.4, 3.4, 3.4, 3.4, 3.6, 3.6, 3.6, 3.6	3.5	2.2, 2.4	2.3	1.52
	2.2, 3.2, 2.8, 2.2, 2.6, 3.2, 2.4, 2.8	2.7	2.0, 2.2	2.1	1.29
	3.6, 3.4, 3.0, 3.6, 3.6, 3.4, 3.8, 3.6	3.5	2.2, 2.4	2.3	1.52

I.P.T. evaporation jets. It was found, however, that jets used in this laboratory made from $\frac{1}{4}$-in. copper or steel tubing to specified dimensions gave identical results and could be used interchangeably. As a matter of interest, it was also found that the air jets could be easily "lined" up with respect to direction of air flow by placing a watch glass containing a small amount of water over the bath opening and noting the location of the impinging air stream on the dish.

Experimental Results

Preliminary data obtained for partially aged samples of full range thermal cracked gasoline showed that both the I.P.T. and A.S.T.M. gum methods gave equally reproducible and accurate results. These data are presented in Table I and are indicative of the agreement to be expected between the two methods for gasolines of low gum content. The ratios of I.P.T. to A.S.T.M. gum values appear to be approximately uniform for these samples, although in this range small differences in the measured gum values appreciably alter these ratios.

Refinery gasoline products, however, may vary considerably in several respects, namely:

1. Amount of initial oxidation products,
2. Gasoline end point and composition,
3. Degree of refinement, and
4. Presence and absence of additives such as tetraethyl lead (TEL).

These various possibilities were each evaluated in order to determine whether a single average ratio of I.P.T. to A.S.T.M. gum values could be applied to all gasolines. These effects were simply determined by measuring rates of gum formation[6] (in the range 0 to 50 mg. per 100 ml.) for a limited number of gasolines, the gasolines being chosen to include the variables indicated above. In most cases, I.P.T. and A.S.T.M. gum values were determined in triplicate for every fresh or oxidized sample in order to increase the accuracy of the measured ratios of the I.P.T. and A.S.T.M. gum values.

Six different gasolines were used for these experiments, namely:

1. Unleaded aviation gasoline.
2. Leaded 100 octane aviation gasoline.
3. Full range thermal cracked

TABLE II.—GENERAL PROPERTIES OF GASOLINES USED IN THE CORRELATION OF I.P.T. AND A.S.T.M. GUM VALUES.

Property	Gasoline No. 1—Unleaded Aviation	Gasoline No. 2—Leaded Aviation	Gasoline No. 3—Full Range Thermal Cracked, Treated	Gasoline No. 4—Full Range Thermal Cracked, Partially Treated	Gasoline No. 5—Light Boiling Thermal Cracked	Gasoline No. 6—Broad Range Thermal Cracked
A.P.I. gravity 60/60 F	56.7	67.0	55.9	55.0	62.9	50.6
Bromine number, g. per 100 g	.....	1	71	72	95	78
Sulfur, per cent by weight	0.01 (3)	0.00 (3)	0.19	0.51	0.20	0.49
A.S.T.M. (air jet) gum, mg. per 100 ml.	0.4, 0.4, 0.6	0, 0.2, 0.2	0.6, 0.8	1.0, 1.4, 1.4	1.8, 2.0, 2.2	1.4, 1.6, 1.8
Peroxide number (Yule and Wilson)	0.02	0.01	0.3	0.3	0.3	0.4
Color, Saybolt	+28	.....	+19	−5	+21	+12
TEL, ml. per gal.	.....	3.0	.....	.....	.....	.....
A.S.T.M. induction period, min.	.....	.....	315	630	300	530
Distillation Test, deg. Fahr.[a]						
Initial boiling point	113	104	117	158	109	131
Final boiling point	343	322	392	390	311	451
10 per cent	153	142	158	192	144	178
50 per cent	207	194	257	242	203	270
90 per cent	306	234	354	343	266	372
Recovery, vol., per cent	98	97.5	98.5	98	98	98

[a] Standard Method of Test for Distillation of Gasoline, Naphtha, Kerosene, and Similar Petroleum Products (D 86 – 40), 1944 Book of A.S.T.M. Standards, Part III, p. 136.

TABLE III.—COMPLETE GUM INSPECTION DATA SHOWING THE RATIO OF I.P.T. AND A.S.T.M. GUM VALUES FOR FRESH AND AGED SAMPLES OF A GIVEN GASOLINE.

Gasoline: 50–50 volume blends of untreated and treated samples of full range thermal cracked gasoline.

	I.P.T. Gum, mg. per 100 ml.		A.S.T.M. Gum, mg. per 100 ml.		Ratio of Average Values, I.P.T./A.S.T.M.
	Individual Values	Average Values	Individual Values	Average Values	
1 (original)	1.6, 1.6, 1.8	1.7	1.0, 1.4, 1.4	1.3	1.31
2	3.6, 3.8, 4.2	3.9	1.8, 2.2, 2.2	2.1	1.85
3	5.8, 6.4, 7.2	6.5	4.4, 4.4, 4.8	4.5	1.44
4	9.4, 10.2	9.8	5.4, 5.8, 6.2	5.8	1.69
5	7.2, 7.4, 7.4	7.3	6.4, 6.6, 7.2	6.7	1.09
6	8.6, 8.6, 8.8	8.7	7.0, 7.2, 7.4	7.2	1.21
7	7.8, 7.8, 8.8	8.1	6.8, 6.8, 7.4	7.0	1.16
8	9.4, 9.6, 10.2	9.7	6.6, 6.6, 6.6	6.6	1.47
9	13.2, 13.8, 13.8	13.6	9.0, 9.0, 9.2	9.1	1.49
10	11.6, 11.8, 12.2	11.9	9.2, 9.6, 9.8	9.5	1.25
11	13.2, 14.4, 14.6	14.1	10.8, 10.8, 12.2	11.3	1.25
12	13.8, 13.8, 14.0	13.9	10.4, 10.6, 10.8	10.6	1.31
13	14.4, 14.8	14.6	11.6, 11.8, 12.0	11.8	1.24
14	18.0, 18.2, 18.6	18.3	14.6, 14.8, 14.8	14.7	1.24
15	22.8, 23.0, 23.8	23.2	15.8, 17.0, 17.0	16.6	1.40
16	27.0, 27.4, 27.6	27.3	19.2, 19.4, 19.6	19.4	1.41
17	33.6, 34.2	33.9	25.2, 27.2, 28.2	26.9	1.26
18	37.8, 38.8, 39.4	38.7	29.6, 30.6, 31.4	30.5	1.27
19	49.0, 49.8, 52.8	50.0	36.0, 37.8, 39.8	37.8	1.32
20	67.2, 79.8, 84.6	77.2	49.8, 50.2, 52.6	50.9	1.52

[6] D. L. Yabroff and E. L. Walters, "Gum Formation in Cracked Gasoline," *Industrial and Engineering Chemistry*, Vol. 32, p. 83 (1940).

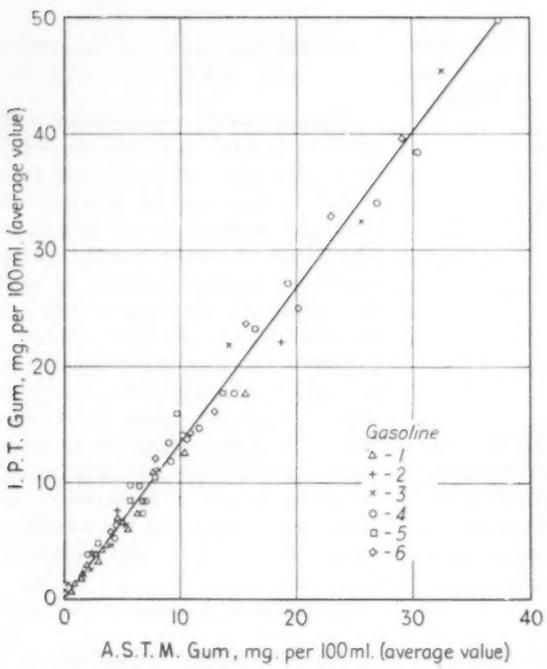

Fig 1. — Ratio of Average Gum Values for Various Fresh and Aged Gasolines.

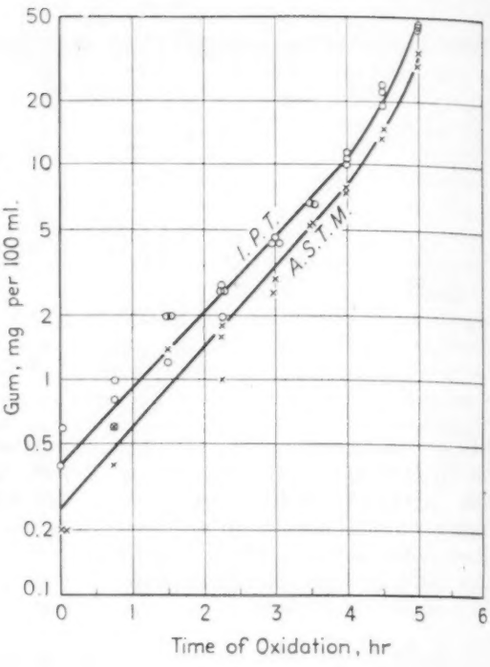

Fig. 2. — Comparative Rates of Gum Formation During the Induction Period of Gasoline 3 at 100 C. and 100 psi. Oxygen.

gasoline, acid treated and rerun.

4. 50–50 blend untreated and treated full range thermal cracked gasoline.
5. Low (300 F.) end point thermal cracked gasoline, partially treated.
6. High end point cracked gasoline comprising a blend of item 3 plus added untreated heavy ends.

The general properties and boiling ranges of these gasolines are listed in Table II.

Complete gum inspection data for one of the gasolines by the two gum methods are shown in Table III. The individual values for either gum method are observed to be fairly reproducible; however, the ratios I.P.T. to A.S.T.M. gum values are observed to vary slightly but in no consistent fashion for different oxidized samples of the same gasoline. The individual differences do not appear to be indicative of a trend in the I.P.T.–A.S.T.M. ratios with increasing gum content but are probably due to uncertainties in the gum measurements themselves.

Figure 1 presents a combined plot of the average I.P.T. *versus* the A.S.T.M. gum values for the six gasolines of Table II, the data for each gasoline being differentiated by means of appropriate symbols.

The average relation between the I.P.T. and A.S.T.M. gum values appears to be uniformly consistent over the entire range of gum values tested, and, further, appears to be identical for each of the gasolines. The value for the experimentally determined average ratio of I.P.T. to A.S.T.M. gums is 1.33; this corresponds to the slope of the line shown in Fig. 1. This experimentally determined ratio appears sufficiently accurate on the whole to be applicable to all the gasolines tested, irrespective of gum content.

As mentioned earlier, rates of gum formation were determined for the six gasolines by the two gum methods at 100 C. and 100-lb. oxygen pressure in order to obtain the necessary samples of different gum content and composition. The gum stability values obtained from these measurements are listed in Table IV. These measurements include "gum time" values for the two methods, the ratios of I.P.T. and A.S.T.M. gum times, and the ratio of I.P.T. and A.S.T.M. gum values at given gum contents. With the exception of the leaded aviation gas-

TABLE IV.—SUMMARY OF GUM STABILITY MEASUREMENTS UNDER ACCELERATED CONDITIONS BY THE A.S.T.M. AND I.P.T. GUM METHODS.

			Gasoline No. 1	Gasoline No. 2	Gasoline No. 3	Gasoline No. 4	Gasoline No. 5	Gasoline No. 6
Induction period, 100 C., 100-lb. oxygen pressure, hr.			>24	.....	5.25	10.50	5.00	8.83
Initial gum, mg. per 100 ml.	I.P.T. Method	Observed	0.6, 1.0, 1.0	0.2, 0.2, 0.4	0.4, 0.6	1.6, 1.6, 1.8	2.6, 2.8, 3.0	2.4, 2.6, 2.4
		Extrapolated[a]	0.60	.....	0.40	3.45[b]	3.0	5.3[b]
	A.S.T.M. Method	Observed	0.4, 0.4, 0.6	0, 0.2, 0.2	0.2, 0.2	1.0, 1.4, 1.4	1.8, 2.0, 2.2	1.4, 1.6, 1.8
		Extrapolated[a]	0.4	.....	0.25	2.6[b]	2.1	3.8[b]
Gum time at 100 C. and at 100-lb. oxygen pressure, hr.	I.P.T. Method	5 mg.	22.50	13.0[c]	3.08	1.42	1.12	0.75
		10 mg.	27.33	15.25[c]	3.93	4.05	2.63	1.67
	A.S.T.M. Method	5 mg.	24.83	14.08[c]	3.45	2.47	1.92	1.29
		10 mg.	28.50	15.50[c]	4.25	5.05	3.42	2.40
Ratio of gum times, I.P.T./A.S.T.M.		5 mg.	0.91	0.92	0.89	0.58	0.49	0.57
		10 mg.	0.96	0.98	0.93	0.80	0.77	0.70
Ratio of gum values, I.P.T./A.S.T.M.		at 5 mg. A.S.T.M. gum time	1.28	1.34	1.34	1.32	1.42	1.37
		at 10 mg. A.S.T.M. gum time	1.38	1.31	1.31	1.30	1.42	1.31

[a] Values corresponding to zero oxidation time.
[b] In the initial oxidation stages these samples do not follow a simple exponential rate. The values reported refer to the extrapolated zero oxidation times corresponding to the linear portion of the rate of gum formation curve.
[c] The rate of gum formation in this sample does not proceed as a simple exponential function.

oline, all of the gum-time measurements were obtained from the usual linear plot of the logarithm of the gum content *versus* the time of aging for the different samples. A typical plot of such data for one of the gasolines is given in Fig. 2.

The data presented in Table IV and Fig. 2 indicate that while the ratio of gum values remains uniformly consistent for all of the gasolines, the ratios of gum times vary considerably for different gasolines and even for the same gasoline at different gum contents. Closer inspection will show that the gum times are dependent on three properties, namely:

1. The initial gum content,
2. The rate of gum formation, and
3. The gum value chosen for the gum time (5 mg., 10 mg., etc.).

For gasolines wherein the formation of gum proceeds as a simple exponential rate, it has been shown[6] that the rate of gum formation in a gasoline at a constant temperature and oxygen pressure may be expressed by the equation:

$$\log \text{gum} = kt + \log I \quad \ldots\ldots (1)$$

where:

k = specific rate constant for formation of gum,
t = time of aging or oxidation (gum time) in hours, and
I = initial extrapolated gum content of gasoline, mg. per 100 ml., corresponding to zero oxidation time.

As pointed out above, this equation assumes the rate of gum formation to obey the simple logarithmic function, as for Fig. 2. In such cases the values of k (slope constant) would be identical for rates of gum formation determined by either the I.P.T. or A.S.T.M. gum methods, or for that matter any two gum methods for which gum values are proportionally related. The values of t and I above would depend upon the gum method employed; however, the ratio of I values (I.P.T./A.S.T.M.) would be, of course, 1.33.

It is possible, knowing the value of k and the value for the gum time t for one method, to calculate the corresponding gum time for the other method by means of the following equations:

$$t_{\text{I.P.T.}} = t_{\text{A.S.T.M.}} - \frac{0.123}{k} \quad \ldots\ldots (2)$$

or conversely,

$$t_{\text{A.S.T.M.}} = t_{\text{I.P.T.}} + \frac{0.123}{k} \quad \ldots\ldots (3)$$

where $t_{\text{I.P.T.}}$ and $t_{\text{A.S.T.M.}}$ refer to the corresponding gum times by the two methods and are independent of the gum value (5 mg., 10 mg., etc.) chosen, and k = the specific rate constant for the formation of gum (described in Eq. 1).

From the above equations, it is evident that gum times by the two methods are not proportionately related but differ from each other by the factor $0.123/k$ which, while representing a constant difference (irrespective of gum time value) for a given gasoline, assumes a different numerical value for different gasolines.

Table V lists the observed and calculated I.P.T. gum times for the various gasolines and calculated values being obtained by applying Eq. 2 above to the measured A.S.T.M. gum time values. Values are listed only for those gasolines in which the logarithmic rate of gum formation proceeded as a simple linear function, that is, in those cases for which the above equation would be valid. In these instances the agreement between the observed and calculated gum times is noted to be excellent.

For gasolines wherein the rate of gum formation does not proceed as a simple exponential function, the value of k (the specific rate constant for gum formation) in addition to varying from gasoline to gasoline, will also vary with increasing gum content for a given gasoline. While no exact relation of gum times can be made in these instances, a reasonably accurate approximation can be made, assuming Eqs. 2 and 3 to be valid and evaluating k as the slope of the tangent of the rate of gum formation curve by either method at the desired gum time. This value of k, having the same units as indicated by Fig. 1, would of course be different at different gum time values (5 mg., 10 mg., etc.) but will, in general, be approximately equal for the same gum time, employing either gum method.

TABLE V.—OBSERVED AND CALCULATED I.P.T. GUM TIMES FOR VARIOUS GASOLINES AT 100 C. AND 100-LB. OXYGEN PRESSURE.

Gasoline	Observed A.S.T.M. Gum Time, hr.			I.P.T. Gum Times, hr.			
				5 mg.		10 mg.	
	5 mg.	10 mg.	k[a]	Observed	Calculated[b]	Observed	Calculated[b]
No. 1...	24.83	...	0.044	22.50	22.04	...	...
No. 3...	3.45	4.25	0.38	3.08	3.12	3.93	3.92
No. 4...	2.47	5.05	0.12	1.42	1.41	4.05	3.99
No. 5...	2.31	3.42	0.20	1.12	1.30	2.63	2.80
No. 6...	...	2.40	0.18	...	...	1.67	1.70

[a] From the equation, log gum = kt + log I.
[b] From Eq. 2.

Conclusions

The experimentally determined value for the ratio of I.P.T. to A.S.T.M. gum values is 1.33. This ratio appears to be consistent for all gasolines within the experimental error, being independent of the gum content, gasoline composition, degree of refinement, boiling range, or presence of additives such as TEL, etc.

Reproducible results of approximately equal accuracy are obtainable by both methods; these appear to be within the tolerable accuracy limits specified in each method.

Gum times by the two methods are not as simply related as gum values. The ratios of gum times vary appreciably from gasoline to gasoline and even for the same gasoline at different gum times. For gasolines wherein the rate of gum formation proceeds as a simple exponential function, gum times by the two methods can, however, be interrelated by an equation which requires knowledge of a single gum time (5 mg., 10 mg., etc.) and the initial gum content by either method. In the other instances, only an approximate, though fairly reliable, estimate can be made of gum times by one method from a measure of gum times by the other method.

A New Method for the Mechanical Analysis of Soils

By Raul Valle-Rodas[1]

EDITOR'S NOTE: This paper was prepared to elicit criticism and discussion. All comments, either for publication or for the attention of the author, should be addressed to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

FOR engineering purposes the mechanical analysis of soils consists primarily in the determination of the percentages of granular material, silt, and clay in the soil. It is based on the principle of sedimentation which can be stated as follows:

In a liquid less dense than the soil, particles of the same material will fall through the liquid with velocities proportional to their sizes.

This principle is expressed by the well-known Stoke's law which gives the rate of fall of a small *sphere* in a viscous fluid. Hence:

$$V = \frac{gd^2(\gamma_1 - \gamma_2)}{18n}$$

where:

V = velocity in centimeters per second,
g = acceleration due to gravity in centimeters per second per second,
d = diameter of the sphere in centimeters,
γ_1 = specific gravity of the sphere in grams per cubic centimeter,
γ_2 = specific gravity of the medium in grams per cubic centimeter, and
n = viscosity in dyne-seconds per square centimeter or poises (changes with temperature).

If the velocity is measured in centimeters per minute, and d in millimeters:

$$V = \frac{gd^2(\gamma_1 - \gamma_2)}{30n}$$

In applying Stoke's law to the determination of the sizes of particles in a soil, the following important limitations should be taken into consideration:

1. The soil particles are not always of spherical shape, since angular, disk, and other shapes are also found. The following relationship established by L. & W. Squires at M.I.T.[2] for equal velocity of sedimentation, gives us an idea of the effect that the shape of the particles has in the process of sedimentation. The tests were performed on disks, and it was found that:

$$D = 0.752D' \sqrt{\alpha}$$

where:

D' = diameter of sphere,
D = diameter of disk,
$\alpha = D/H$, and
H = height of disk.

2. The Stoke's formula studies the motion of one sphere only, and, therefore, the reciprocal interference or influence among particles is also unknown.

3. The specific gravity taken in the computation of the diameter of the particles represents the "average" specific gravity of the whole soil sample and not the corresponding specific gravity of the computed particle. Any correction factor will be, therefore, a correction to that "average" specific gravity only.

All the above-mentioned limitations, among others, show us that since the *degree of approximation* in making the different assumptions is unknown, the results obtained by applying Stoke's law must be regarded as *approximations* only.

Actually there is no exact method for determining the particle-size distribution in a soil. All the methods used are based upon the principle of sedimentation and, therefore, all of them, *regardless of the different correction factors which can be applied* are approximations for the reasons pointed out before.

Whenever approximate results will be obtained, tests should provide quick and simple methods rather than elaborate ones, so as to furnish engineers and laboratory technicians with results of *sufficient accuracy* in a short time. Aiming to accomplish this, the author presents a new procedure, appended hereto, for determining the particle-size distribution in a soil. It is based also on the principle of sedimentation as is the hydrometer method (A.S.T.M. Method D 422-39[3]) and other proposed tests. It provides the same degree of accuracy as the hydrometer method with the following advantages:

(*a*) It cuts down the time of performance from more than two days to less than one-half day.

(*b*) It avoids many computations and the use of correction factors, charts, and diagrams.

(*c*) It can easily be performed with a minimum amount of equipment.

(*d*) It does not require the determination of the specific gravity of the soil sample.

(*e*) It can be performed at any reasonable prevailing temperature (from 50 to 86 F.), without applying correction factors.

(*f*) It can be used to separate the soil constituents when necessary. This procedure can be considered as a test by itself, since there is no actual test which provides a means of separation of the soil constituents.

The results were compared with those obtained by means of the standard or hydrometer method, and, as can be seen from the comparative Table III, the difference between the two methods is negligible for all practical purposes.

In this new method, the velocity at which a soil particle of a certain size falls through a viscous liquid was determined, according to Stoke's law, for different temperatures and specific gravities.

Since particles having a diameter of 0.05 to 0.005 mm. are classified as silt, the mean velocity of fall for particles of this size will be given as shown in Table I.

Some of the values obtained in Table I correspond to extreme conditions rarely found in the laboratory. However, it gives us an idea of how changes in temperature and specific gravity influence the results.

The settling period of silt parti-

[1] State Highway Department, Salem, Ore.
[2] See the list of references appended to this paper.
[3] 1944 Book of A.S.T.M. Standards, Part II, p. 616.

TABLE I.

Temperature		Specific Gravity, g. per cu. cm.	Velocity Corresponding to a Diameter d = 0.05 mm., cm. per min.	Velocity Corresponding to a Diameter d = 0.005 mm., cm. per min.	Mean Velocity for Silt Particles, cm. per min.[a]
deg. Fahr.	deg. Cent.				
50	10	2.95	12.18	0.122	1.22
		2.65	10.30	0.103	1.03
		2.25	7.81	0.078	0.78
68	20	2.95	15.85	0.158	1.58
		2.65	13.41	0.134	1.34
		2.25	10.16	0.102	1.02
86	30	2.95	19.89	0.199	1.97
		2.65	16.82	0.168	1.68
		2.25	12.75	0.127	1.27

[a] The mean velocity was taken as the square root of the product of the velocities corresponding to the largest and the smallest size of silt particles. In the same way, the mean velocity for clay particles was computed (Table II).

cles was taken as *1 cm. per min.* This value, as it can be seen from Table I, provides a great safety factor because at the end of this period silt particles will complete their settlement regardless of changes in temperature or specific gravity. The amount of clay that could settle will be negligible. Thus, if we consider the *extreme condition* of 86 F. and 2.95 specific gravity, the largest clay particles (d = 0.005 mm.) will fall with a velocity of 0.199 cm. per min. only, and since the soil suspension occupies a 20-cm. height in the glass container or graduate (see Test Procedure in suggested method), only a negligible amount of the portion which remains at the bottom of the container could settle.

For engineering purposes the determination of sand, silt, and clay provides, in most of the cases, sufficient data. However, if the amount of colloidal particles has to be determined, the settling period for clay particles should be established. Table II gives the velocity of fall for these particles at different temperatures and specific gravities.

In performing the test, a velocity of 0.020 cm. per min. was chosen for the settlement of clay particles. This value provides also a great margin of safety, for the same reasons as stated before, regardless of changes in temperature and specific gravities.

A comparison of the results obtained by both methods, A.S.T.M. Method D 422 and the one suggested in this paper is given in Table III. In some cases the soil suspension was heated in order to obtain high temperatures and study the effect of temperature in the suggested method. The specific gravity varied from 2.38 to 2.75.

As can be seen, the difference of the results obtained by means of both methods is negligible.

Acknowledgment:

The author wishes to acknowledge gratefully to R. H. Baldock, State Highway Engineer; C. B. McCullough, Assistant State Highway Engineer; N. M. Finkbiner, Engineer of Materials; and the personnel of the Oregon State Highway Department for all the assistance given him during the performance of the tests.

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(1) Gregory P. Tschebotarioff, "Notes on Soil Mechanics," Associate Professor, Princeton University, Princeton, N. J.

(2) "Notes on Principles and Applications of Soil Mechanics, Corps of Engineers," U. S. Army, Fort Peck, Mont.

(3) Procedures for Testing Soils, Am. Soc. Testing Mats. (1944). (Issued as separate publication.)

(*a*) A.S.T.M. Standard Method of Preparing Soil Samples for Mechanical Analysis and Determination of Subgrade Soil Constants (D 421–39), p. 17.

(*b*) A.S.T.M. Standard Method of Mechanical Analysis of Soils (D 422–39), p. 19.

(*c*) Suggested Modification of Standard Method of Mechanical Analysis of Soils (D 422–39), proposed by R. D. Finney, p. 46.

(*d*) Suggested Modification of Standard Method of Mechanical Analysis of Soils (D 422–39), proposed by Edward E. Bauer, p. 48.

(*e*) Suggested Method for Mechanical Analysis of Soils by Elutriation proposed by W. H. Mills, Jr., p. 53.

(4) "Reports on Subgrade Soil Studies," reprinted from *Public Roads*, Vol. 12, Nos. 4, 5, 7, and 8, June, July, September, and October, 1931.

(5) G. J. Bouyoucos, "The Hydrometer Method for Making Mechanical Analysis of Soils," March 1, 1935.

TABLE II.

Temperature		Specific Gravity, g. per cu. cm.	Velocity Corresponding to a Diameter d = 0.005 mm., cm. per min.	Velocity Corresponding to a Diameter d = 0.001 mm., cm. per min.	Mean Velocity for Clay Particles, cm. per min.
deg. Fahr.	deg. Cent.				
50	10	2.95	0.122	0.0049	0.024
		2.65	0.103	0.0041	0.020
		2.25	0.078	0.0031	0.016
68	20	2.95	0.158	0.0063	0.032
		2.65	0.134	0.0054	0.027
		2.25	0.102	0.0041	0.020
86	30	2.95	0.199	0.0080	0.039
		2.65	0.168	0.0067	0.033
		2.25	0.127	0.0051	0.026

NOTE.—One of the practical applications of this new method of decantation is that it provides a mean for the separation of the different soil constituents. Thus, when large amounts of silt or clay are needed they can be obtained by this method. Although it is obvious that larger amounts and larger containers will be needed, the procedure will be the same.

TABLE III.

Temperature, deg. Fahr.	Specific Gravity, g. per cu. cm.	Material	Percentage of Material Determined by Method D 422	Percentage of Material Determined by the Suggested Method
70.....	2.55	Coarse sand	45	41
		Fine sand	21	23
		Silt	22	24
		Clay	12	12
69.....	2.60	Coarse sand	51	50
		Fine sand	17	18
		Silt	20	19
		Clay	12	13
80.....	2.42	Coarse sand	64	60
		Fine sand	14	15
		Silt	16	17
		Clay	6	8
90.....	2.50	Coarse sand	54	52
		Fine sand	14	14
		Silt	20	21
		Clay	12	13
68.....	2.68	Coarse sand	46	42
		Fine sand	20	23
		Silt	22	23
		Clay	12	12
75.....	2.38	Coarse sand	34	31
		Fine sand	24	25
		Silt	32	32
		Clay	10	12
70.....	2.50	Coarse sand	6	6
		Fine sand	30	29
		Silt	46	44
		Clay	18	21
70.....	2.75	Coarse sand	2	1
		Fine sand	6	5
		Silt	70	69
		Clay	22	25
68.....	2.69	Coarse sand	6	5
		Fine sand	18	15
		Silt	65	68
		Clay	11	12

Suggested Method for Mechanical Analysis of Soils

Scope:

1. This method of test describes a procedure for determining the percentages of the different particle sizes in a soil.

Apparatus:

2. (*a*) *Balance.*—A balance sensitive to 0.1 g.

(*b*) *Stirring Device.*—An electric stirring apparatus with replaceable stirring paddle, and a dispersion cup with baffle rods. (Suitable apparatus is described in the A.S.T.M. Standard Method of Mechanical Analysis of Soils (D 422 – 39)[3].)

(*c*) *Drying Device.*—An electric oven or any other suitable heating-drying device which can maintain a temperature of about 110 C.

(*d*) *Glass Containers.*—Glass containers 10 in. in height and not less than 2½ in. in inside diameter. (Larger containers and graduates may also be used.)

(*e*) *Circular Tin Disk.*—A circular tin disk attached to a rod (Fig. 1 (*D*)), or some other suitable device so as to prevent siphoning of the settled soil at the end of the settling period.

(*f*) *Siphon.*—A rubber tube or any other suitable siphon device to wash off the soil in suspension after the settling period.

(*g*) *Beakers.*—Beakers of 600-ml. capacity.

(*h*) *Sieves.*—A series of sieves, of square-mesh woven wire cloth, conforming to the A.S.T.M. Standard Specifications for Sieves for Testing Purposes (E 11 – 39).[4] The sieves required are as follows:

Size or Sieve Designation	Sieve Opening, mm.
No. 10 (2000 micron)	2.000
No. 60 (250 micron)	0.250
No. 200 (74 micron)	0.074

Reagents:

3. (*a*) *Dispersing Agents.*—Any of the following agents may be used: hydrogen peroxide, sodium hydroxide, sodium carbonate, sodium oxalate, or ammonia.

(*b*) *Deflocculating Agents.*—Sodium silicate or gum arabic.

Sampling:

4. A representative 5-kg. sample of the soil shall be taken by the method of quartering or by the use of a sampler. The lumps shall be broken in the mortar and the soil thoroughly mixed.

Procedure:

5. (*a*) Use 50 g. of the oven-dry material passing the No. 10 sieve for silt or clay soils, and 100 g. for sandy soils.

(*b*) Place the soil in a beaker and add about 300 ml. of water, stirring constantly and thoroughly until the soil is completely wetted, and let the mixture stand for 1 hr. in the case of sandy soils. In the case of silty or clay soils, add 100 ml. of hydrogen peroxide (6 per cent) or of sodium hydroxide (3 per cent), or add 5 ml. of sodium oxalate (saturated solution), and let the mixture stand for at least 3 hr. Stir the mixture thoroughly when the dispersing agent is added. If the soil tends to flocculate, add before dispersing the mixture, 20 ml. of a solution of sodium silicate (3° Baumé) or 50 ml. of a solution of gum arabic (45.2 g. of gum arabic in 1 liter of water). The dispersing and the flocculating agent as well as the amount and the degree of concentration to be used can be changed according to the type of soil.

(*c*) The mixture shall then be washed into the dispersion cup and dispersed in the stirring apparatus for a period of 5 min. for sandy soils and 10 min. for silt and clay soils.

(*d*) After the soil is dispersed, transfer the mixture into the glass graduate or container and fill it up to a 20-cm. height. Shake the contents thoroughly for 1 min., turning the cylinder upside down and back several times with the palm of the hand used as a stopper over the mouth of the graduate.

(*e*) After the shaking operation is completed, place the cylinder on the table, record the time, and let the soil in suspension settle for 20 min.[5]

(*f*) At the end of 20 min. (settling period) introduce carefully the circular tin disk until it touches the soil which has settled at the bottom of the cylinder

[4] 1944 Book of A.S.T.M. Standards, Part II.

[5] If the contents in the glass cylinder or container do not occupy a height of 20 cm., the settling time of 20 min. should be changed by adding or subtracting 1 min. for each centimeter higher or lower than the 20-cm. height. The settling period for silt particles was taken as 1 cm. per min.

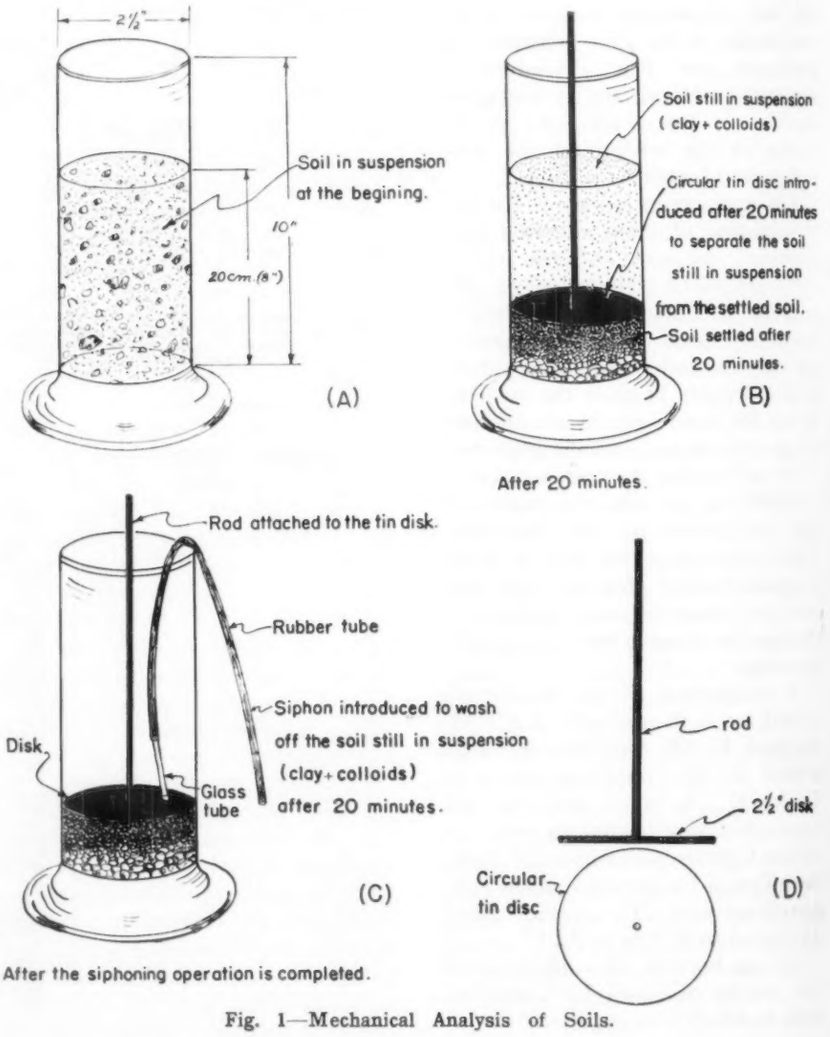

Fig. 1—Mechanical Analysis of Soils.

or glass container, and after 1 min. carefully siphon the soil which still remains in suspension.

(*g*) Carefully remove the material remaining at the bottom to a beaker or to other suitable container. (The use of a wash bottle is suggested when the material is removed.) Let the beaker stand for a certain time (about half an hour), and remove the water before oven-drying the soil.

(*h*) Weigh the oven-dried soil and sieve it on sieves Nos. 60 and 200. Record the weight of the soil retained on each sieve and the weight passing the No. 200 sieve and determine their percentages based on the total weight of the original oven-dry sample.

Report:

6. The material retained on the No. 60 sieve shall be reported as coarse sand, the material retained on the No. 200 sieve as fine sand, and the material passing the No. 200 sieve as silt.[6] The difference between the weight of the original oven-dry soil and the weight of the oven-dry remaining material shall be reported as clay.

[6] For practical purposes, material passing the No. 200 (74 micron) sieve can be classified as silt.

EXPLANATORY NOTES

NOTE 1: *Example A.*—The following example is given. All the material passes the No. 10 sieve.

Weight of original oven-dry soil	50.0 g.	
Weight of remaining oven-dry soil after siphoning the material in suspension	44.0 g.	
Difference (clay)	6.0 g.	12.0 per cent
Weight of material retained on the No. 60 sieve (coarse sand)	20.0 g.	40.0 per cent
Weight of material retained on the No. 200 sieve (fine sand)	17.0 g.	34.0 per cent
Weight of material passing the No. 200 sieve (silt)	7.0 g.	14.0 per cent
		100.0 per cent

NOTE 2.—If only a certain percentage of the material passes the No. 10 sieve, the above figures should be multiplied by that percentage in order to obtain the actual percentages of sand, silt, and clay. The percentage of material retained on the No. 10 sieve is reported as "particles larger than 2 mm." It is understood that if there is a large amount of rock it should be screened on the following sieves, conforming to A.S.T.M. Specifications E 11: 2 in., 1½ in., 1 in., ¾ in., and ⅜ in., No. 4, and No. 10. The percentages retained on each sieve shall be reported.

NOTE 3.—If the amount of colloidal material is to be reported, the soil which has been siphoned according to Section 5 (*f*), be transferred to another glass cylinder or container which shall be filled to the 20-cm. height, adding some water if necessary. Allow the material which was siphoned to settle for 17 hr.[7] At the end of this settling period introduce the circular tin disk and siphon the soil which still remains in suspension. Carefully remove, oven-dry, and weigh the material which remains at the bottom. The soil in suspension so washed off in this second operation is colloidal material.

NOTE 4: *Example B.*—The material reported as clay in Example *A* (Note 1) contains a certain amount of colloidal particles, which can be determined as follows:

Weight of oven-dry material reported as clay	6.0 g.
Weight of oven-dry remaining soil after the second siphoning	4.8 g.
Difference (colloidal material)	1.2 g.

The 12 per cent (6 g.), referred to as clay in Example *A*, contains, therefore, 9.6 per cent of clay (4.8 g.) and 2.4 per cent of colloidal particles (1.2 g.).

[7] If the contents of the mixture siphoned for the second time do not occupy a height of 20 cm. in the glass cylinder or container, the settling time of 17 hr. should be changed by adding or subtracting 50 min. for each centimeter higher or lower than the 20-cm. height. The settling period for clay particles was taken as 0.020 cm. per min.

Tomorrow's Textiles—Yesterday's Test Methods[1]

By J. B. Goldberg[2]

THE postwar period promises numerous new fibers, fabrics, and finishes but our evaluation of their merits depends on the soundness of our testing procedure and interpretation of the data. Before becoming too concerned with the potentialities of the textiles of tomorrow there is a definite need for improvement in the testing technique used today.

For example, in the outerwear field, it is reasonable to assume that there will be considerable development of comparatively light-weight fabrics which are important in such clothing—heat insulating properties, wind and rain resistance, and resistance to wear, but we are lacking the simple instruments and standard methods of measuring these properties and the interpretation of results which will mean something to the consumer.

For measuring thermal insulation there is need for an instrument that will give reproducible results on a sample in less than several hours, that can be operated by someone who is not a trained physicist, and the results of which can be translated into comparatively simple standard units.

With the rapid developments being made by the chemists to provide better and more durable water-repellent finishes, we are certain to see wider applications to tomorrow's fabrics. Although we have a standard hydrostatic test, a spray test, and a water-immersion test, what a consumer wants to know is "Will this fabric as a raincoat keep the rain out and for how long?" or, "Will this shower curtain resist hot water, cold water, and soap for a reasonable length of time?" There is need for a simple specific test to evaluate the suitability of fabrics to be used in raincoats and a means of interpreting the facts so that the layman can understand them.

A great deal of emphasis has been placed on the air permeability of clothing used by our armed forces, and it is safe to assume that this characteristic will receive a certain amount of promotion in the garments of tomorrow. The Bureau of Standards' instrument, originally developed about 13 years ago, is reasonably good to measure the air flow through parachute fabrics, but it is of doubtful value on the less permeable, so-called wind-resistant fab-

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Extended Abstract of paper presented at the October, 1944, meeting of Committee D-13 on Textile Materials, New York, N. Y.

[2] Research Director, J. P. Stevens & Co., Inc., New York, N. Y.

rics. For testing such fabrics the instrument in use today is the Gurley Densometer, but it was originally designed for the testing of paper and leaves much to be desired when used for testing fabrics.

Tear resistance is a term which is very familiar to those of us who have been concerned with the delivery of parachute fabrics to the Ordnance, Air Corps, and Navy Departments. There are a variety of so-called standard test methods—strip, trapezoid, Finch, and Elmendorf, but nobody seems to be quite sure of which test means what in terms of fabric performance.

Resistance to puncture, which is actually the initial starting point of a tear (excluding parachute fabrics), is of great importance, yet we have no standard method for making such a test.

Breaking strength is one item which is almost always included among the specifications for textile materials, whether they are going into sheets or parachutes, dress goods or tents. Serious consideration should be given to the problem of improving the reliability of the information provided with tensile strength testing machines of today, and restricting the inclusion of such test results to specifications where we have definite proof of their significance.

For work clothing and certain outerwear, the abrasion resistance of fabrics is an extremely important property. Some fibers, constructions, and finishes are said to contribute to increased abrasion resistance but there is no testing machine that meets with the approval of the A.S.T.M., or any other technical group whose duty it is to lead the way in developing standard test methods.

In the field of dress goods and suitings where cotton and rayon are concerned, it is expected that considerable emphasis will be placed on crease resistance, resilience, crush resistance or wrinkle-proofing. These characteristics are of course important in numerous other items, such as blankets, neckties, pile upholstery, interlining, cushion filler, and rugs. We have heard of countless claims made for the synthetic resins and fibers themselves which are supposed to make a woman's dress crease-proof or make a crease stay in a pair of men's slacks, depending on which claim will sell the most goods, but we have no good testing instrument or method for determining these characteristics.

Fabric stability is another much-discussed item, but how are we to test a fabric's stability when we still do not have a good foolproof ordinary wash test for the determination of shrinkage in rayon fabrics? As recently as October, 1944, the American Association of Textile Chemists and Colorists Committee for studying the dimensional changes in fabrics in home laundering, dry and wet cleaning, reported that we are still far from solving the problem of how to make suitable laboratory tests and how to correlate them with actual performance. Perhaps the solution lies in the successful chemical and mechanical finishing of properly constructed fabrics which will permit the use of cotton wash tests. To be perfectly honest, perhaps our test methods are not so bad, and the difficulty lies in the efforts of some technicians to convince themselves or others that when a rayon fabric shrinks or stretches too much the technique must be wrong.

Fabric stability also involves the determination of undirectional and multidirectional creep under both single applications of load and repeated stress. How can we assure a woman that a fabric will not stretch, sag or bag when we have no approved standard test method to satisfy ourselves?

Although the importance of colorfastness may be considered a problem for the chemists rather than members of the A.S.T.M., the development of a suitable piece of equipment for the determination of the light fastness should be of interest to all of us. The so-called standard method for measuring resistance to light is apparently unsatisfactory since I have been told that there are not many instruments which can be relied upon to give check results. It has also been reported that the standard wash tests for color fastness are inadequate. Here again, the easiest way out would be the development and application of dyestuffs which are so fast to light and washing that they will pass the most severe test on any machine.

There are other tests which leave much to be desired before we can say that we are prepared to meet tomorrow's textiles. These include tests for resistance to mildew of various types, resistance to moth damage, flameproofing, fabric shifting or slippage.

Fortunately, there are active groups working on improving our test methods for many of these properties. Under private sponsorship, new testing instruments are being designed to give true characteristics of fibers and fabrics under constant and repeated stress and impact loads. In addition, a new approach is being made to the study of resilience. In one of the commercial research laboratories, new technique has been developed to make the testing of yarn and fabric abrasion resistance a scientific operation with results that can be readily reproduced and interpreted into fabric performance. Similar work is being done in these same laboratories to simplify the measurement of thermal insulation of textiles.

Another commercial laboratory has recently announced the development of an instrument to measure the slippage of yarn in fabrics, and we hope that this will stimulate sufficient interest to consider its approval as a standard test method, or the proposal of some better method. The combat course at Camp Lee has yielded worthwhile information on the durability of clothing, and the experimental shower room at the Philadelphia Quartermaster Depot has been used to evaluate the resistance of fabrics to rainfall under varying conditions.

There are undoubtedly many other agencies cooperating in the testing of the thousands of textile materials going to the armed forces, and we look forward to the time when this information will be available to aid and guide us in a more intelligent study of the physical and chemical properties of fabrics.

In the meantime, let us stop dreaming about tomorrow's textiles and wake up to realize that we do not know enough about the fabrics we have with us today.

170th Anniversary of the Engineer Corps

Army Engineers Participate in A.S.T.M. Work; Make Wide Use of A.S.T.M. Standards

ON JUNE 16, 1775, the same day that George Washington accepted his appointment as General of the Continental Army in Independence Hall a few blocks from where this note is being written, Congress appointed a Chief Engineer, stating that he should be in a separate department with two assistants under him, he should receive $60 a month and his assistants $20 a month. Colonel Richard Gridley was the first Chief Engineer. Later Washington expanded upon the Engineers, insisting that there be a Federal Corps and it should have a training school. When reorganized in 1802, the Army continued its Corps of Engineers and it is of interest to note it operated the Military Academy at West Point until 1866.

Even in peacetime the Corps of Engineers maintains a very extensive series of projects involving river and harbor work, flood control, dams, etc. Their part in the present war, both in Europe and in the Pacific needs no elaboration in this BULLETIN. The first ground troops to see action in the Southwest Pacific were an Engineer outfit building a landing strip at Milne Bay.

All Americans extend congratulations to the Corps of Engineers on their 170th birth year.

THE CORPS AND A.S.T.M.

For many years the War Department has been represented on many A.S.T.M. committees and the Corps of Engineers has designated official appointees to serve in several technical groups. Thus this important branch of the armed forces, like others, is aiding in developing specifications and tests which in turn it can use effectively. Presumably the places where materials covered by A.S.T.M. standards have been used is almost legion. The Office of the Chief of Engineers points out that among the categories where A.S.T.M. standards have emphasis are the following: steel bridging; mild steel plate; welded and seamless steel pipe; carbon-steel plate; weight of coating on zinc-coated steel; gray iron castings; structural rivet steel; electrodeposited zinc coatings on steel; arc-welding electrodes, both iron and steel; carbon steel forgings for general industrial use; uniformity of coating on zinc-coated steel; tinned soft and annealed copper wire for electrical purposes; compressive strength of concrete; penetration of bituminous materials; water in petroleum products; methods of testing oleoresinous varnishes, pigments, and paints; and tension testing of metallic materials. In

A Peace-Time Project Showing the St. Georges Bridge Over the Chesapeake and Delaware Canal. Photographed in October, 1941.

U. S. Army Signal Corps Photograph

A Crane Operated by Combat Engineers Swings Bridge Pontoons, Destined for Use in Bridges Across the Rhine, from a Railway Flat Car to a Trailer on the Seventh Army Front.

U. S. Army Signal Corps Photograph

A Stiff-leg Derrick Operated by a Port Construction Repair Company of the U. S. Army Engineers Places Railroad Bridge over the Rhine Replacing the One Wrecked That Is Shown Nearby.

Work is on a round-the-clock schedule. Thirty piers are in the new railroad bridge, the longest span about ninety feet.

U. S. Army Signal Corps Photograph

First 7th U. S. Army Customer at a Forward Area in France Stops to Gas Up from a Long Fuel Line Supplying 7th Army Troops During the Sweep to the Rhine.

addition to these direct uses, A.S.T.M. standards, of course, are embodied in Army, Federal and Joint Army and Navy specifications which in turn are used by the O.C.E. It was further pointed out that in addition to the specification requirements, A.S.T.M. standards are frequently consulted for authoritative criteria.

On this and the following pages are a number of photographs, some of them striking illustrations of effective work by the Corps of Engineers. Taken together, perhaps they symbolize more than any amount of words could, the important place this Corps occupies in peace and in war.

Machines Cannot Think

THOMAS R. AGG, Dean of Engineering, Iowa State College, a long-time member of A.S.T.M., in the March, 1945, *Iowa Engineer* covers in his trenchant Dean's Message thoughts on the subject "Machines Cannot Think." The closing paragraph reads: "Engineering has permeated the war activities both on the home front, where the instruments of warfare are fabricated, and the fighting zones. Engineering will pace the return to peacetime production and normal living. Even after the return of the engineers who are now in military service, there will be a serious shortage of engineers. The engineer by the very nature of his work must serve as an individual even though he is a member of an engineering staff which may be large or small. Individual opportunity limited only by ability will continue to exist for the engineer who is prepared for the exacting technical and personal responsibilities of leadership."

U. S. Army Signal Corps Photograph

Supplies reach front faster over new all-welded bridge. Built by Company "F," 360th Engineers, with delta base section near Marseille, France, this span didn't require bolts or rivets. It holds 35 tons, cuts convoy time over Rove Canal by thirty minutes; saves a five-mile detour. Men in the jeep are from Union, N. J.; Port Arthur, Texas; St. Charles, Idaho; and Blackwell, Oklahoma.

A Loading Test at a Delaware Airport Showing the General Setup for Evaluating the Subgrade.

Standards Institution of Palestine

THE Standards Institution of Palestine, recently inaugurated by Viscount Gort, is a joint undertaking of the Government, the Jewish Agency, the Association of Engineers and Architects, the Municipal Corporation of Tel-Aviv, the Manufacturers' Association, and the Industrial Council. It has the following objects: Publication of standard specifications for industrial products and materials; testing of commodities which are covered by standard specifications; commercial or control testing of commodities not standardized; and promotion of research in relation to standardization and concerning properties of materials in general. Individuals and firms desirous to promote the object of the Institution are eligible for Associate membership.

The Institution, to carry out its testing activities, has taken over from the Association of Engineers and Architects, its laboratory for testing materials in Tel-Aviv, together with its present staff. Committees on standards and on testing have been set up for the purpose of directing and coordinating the various activities. The Institution contemplates publishing its own Journal in connection with the Journal of the Association of Engineers and Architects.

The Director of the Institution, Arnold Arnstein, who has been for the last 20 years in charge of the Laboratory for testing materials, is a member of A.S.T.M. Communications can be addressed to the Engineers' Institute, 200 Dizengoff Rd., Box 6001, Tel-Aviv, Palestine.

Committee D-14 on Adhesives—Symposium Planned

AN INTENSIVE two-day series of meetings of subcommittees of Committee D-14 on Adhesives was held at Society Headquarters on June 19 and 20 on the first anniversary of the formal organization of D-14 and the main committee met in New York City on June 26. At this series of meetings the work of the various subcommittees during the past year was discussed and consideration given to the work to be undertaken during the coming year. Much work has been done in studying and evaluating existing knowledge in the field of adhesives. From this work certain methods have been selected for further study and development. At the present time there appear to be few, if any, methods fully standardized for tests in this field.

In selecting the test procedures most promising for future standardization or in the development of entirely new procedures, one of the chief problems has been the selection of the most satisfactory test specimen. The selection of specimens has been complicated by the fact that the properties of adhesives of greatest interest are, for the most part, dependent on the materials being adhered (as in the case of sandwich materials) and the manner in which they are used rather than on simple properties of the adhesive itself. However, good progress is being made and several of the subcommittees already have methods of test nearly ready for comment or for round-robin testing by the members of the committee.

Among the tests where progress has been most promising are the following:

1. Tensile strength test.
2. Compression shear test.
3. Tensile shear test.
4. Repeated reversed-stress in flexure.
5. Effect of temperature and moisture.
6. Resistance to chemical reagents.

At the main meeting the following permanent officers were elected:

Chairman: R. C. Platow, Bell Telephone Laboratories, Inc., New York, N. Y.

Vice-Chairman: P. H. Bilhuber, Vice-President, Steinway and Sons, New York, N. Y.

Secretary: H. S. Grinsfelder, Senior Engineer, The Resinous Products and Chemical Co., Inc., Philadelphia, Pa.

Progress reports were presented by the subcommittee chairmen and the belief was expressed that methods of test should soon be forthcoming for publication. Upon the development of methods of testing it will be possible for the committee to proceed with the development of specifications for adhesives.

Consideration was given to the Symposium on Adhesives to be held at the Fall meeting of Committee D-14. It is planned to present eight papers on the following general subjects; the authors are noted also:

Classes and Uses of Adhesives, by T. R. Truax, Forest Products Laboratory.

A General Theory of Adhesion, by Robert Rinker, Bureau of Standards.

Strength Properties, by R. C. Platow, Bell Telephone Laboratories, Inc., Chairman, Subcommittee I.

Analytical Tests, by Leonard Repsher, Bakelite Corp., Chairman, Subcommittee II.

Permanency, by Fred Wehmer, Minnesota Mining and Manufacturing Co., Chairman, Subcommittee III.

Working Qualities, by C. B. Hemming, United States Plywood Corp., Chairman, Subcommittee IV.

Specifications, by Gerald Reinsmith, Ordnance Dept., Chairman, Subcommittee V.

Nomenclature, by G. M. Kline, National Bureau of Standards, Chairman, Subcommittee VI.

This symposium has been developed by a committee under the Chairmanship of Eugene R. O'Hare, Technical Director, Casein Company of America, Division of the Borden Co., New York, N. Y., and includes the various subcommittee chairmen.

Each paper, while primarily the effort of the subcommittee chairman, is being submitted to the respective subcommittee members for their comment and suggestions. These papers will cover existing knowledge in the field of the subcommittees and findings and conclusions reached by the subcommittees of the respective subjects covered. It is planned to publish the papers and discussions but further announcement of this will be made.

A.S.T.M. Standards Abroad

A.S.T.M. specifications and tests are very widely used and are applied in their entirety or form the basis of many standards used in foreign countries. Many copies of the Book of Standards are distributed abroad, and separates and the special compilations are also sent out in increasing numbers.

It is interesting in line with this to note in the June issue of *Rock Products* an article by Jorge Boiso covering the Argentine lime industry where he refers to the necessity of quality specifications and says that "standard specifications have been set up by the Laboratory of Testing Materials of the City of Buenos Aires and also by the Province of Buenos Aires. The standards I.R.A.M., corresponding to A.S.T.M., now being formulated by a special committee, will provide a national standard for hydraulic lime, taking as a base the standard tests of A.S.T.M."

Many Tests Required for Quality Control

AN INTERESTING article in the current *Pipe Progress*, house organ of the American Cast Iron Pipe Co., stresses the extensive work required in maintaining quality control. For example, it is indicated that in chemical analysis, involving not only melts and the finished products, but samples of raw materials as well, such as ferro-alloys, an average day's work might include the following number of determinations:

Silicon	41	Nickel	1
Sulfur	68	Molybdenum	2
Manganese	32	Chromium	2
Phosphorus	45	Copper	2
Carbon	62		

In the physical laboratory where all kinds of tests are necessary—hardness, tensile, etching, impact, etc.—the daily number is well over 100 and periodically a complete pipe bursting test is carried out. Sand for molds and cores must be checked; also tars and other material used. Some of the methods have been speeded up, of course—carbon, for example, where a rapid combustion method will give results in five minutes from time of pouring—and a spectrograph is used to check products containing alloys, etc. The latter might run around 200 determinations daily.

The interesting article included illustrations of various laboratory tests. Some 22 people are required to carry out the work in the laboratories. All of this work at the American Cast Iron Pipe Co. is under the direction of Dr. J. T. MacKenzie, currently a member of the A.S.T.M. Executive Committee.

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SOUTH BROAD ST.
PHILADELPHIA 2, PENNA.

Progress on New Society Headquarters

THE MEMBERS will be interested in developments regarding the new Society Headquarters since Letter Circular No. 265 was mailed on June 22.

Perhaps most important of all, the Society acquired title to the property on August 1. The building, situated at 1916–18 Race St., Philadelphia, has been used for some years as an apartment house, so that complete physical possession requires the termination of present leases. All the necessary legal steps have been taken, the former owner having helpfully cooperated in every way. Satisfactory progress is being made and a number of the tenants have already moved. The Society will have to maintain and operate a few apartments until the leases are terminated, for which purpose the firm of C. J. Mitchell, Co., Inc., has been engaged as management agent. Mr. Charles J. Mitchell, president of the firm, negotiated the purchase of the property for the Society.

Meanwhile studies are progressing on the remodeling of the building. Mr. Sylvester L. Smith, Mem. AIA, has been engaged as architect and has submitted several alternative plans which are now being studied and will shortly be submitted to the Committee on Building. As might be expected from the nature of the present occupancy considerable interior alterations will be required. As explained in the Letter Circular, the Executive Committee desires to remodel the building in the most effective way to meet the Society's requirements for its general offices, its library, facilities for storage and distribution of its publications, and as headquarters for officers, directors and members of the Society and for conferences of its administrative and other committees. Contracts for the work will be let as soon as possible.

Notes on the Permanent Headquarters:

As detailed in Letter Circular to Members No. 265 and in the 1945 Annual Report of the Executive Committee, the permanent Headquarters will be the fourth location for the Society offices. Successively they were at the University of Pennsylvania from which they were transferred to the Engineers' Club in 1919, and finally to the Atlantic Building at 260 S. Broad Street, where our present Headquarters, several times expanded, are located and where there has been an excellent tenant-owner relationship.

The new property, about a half mile northwest of Philadelphia's City Hall on the Benjamin Franklin Parkway, is on Logan Square, and included in the group of buildings nearby are the Franklin Institute, the Philadelphia Public Library, and adjoining it is the Academy of Natural Sciences.

As indicated, the present Headquarters are badly crowded, and with no future expansion possible (the present lease cannot be renewed because of demands for space by the owner of the building) new headquarters had to be sought. There is no question but that the approximately 100 per cent increase in space which will result when the alterations are completed in the new building will permit a better realignment of working facilities, but of equal importance are adequate office space and facilities to take care of expansions in the staff which are sure to come.

Executive Committee Desires Widespread Participation in Building Fund

WHILE excellent progress is being made on the Building Fund which is to be used for the purchase and renovation of the new Headquarters (up to July 30, $105,515 had been contributed,—see accompanying article), the Executive Committee is most desirous that there shall be widespread participation on the part of the individual members of the Society. Already a goodly number have contributed and each mail brings additional gifts.

As would be expected from the technical nature of the Society's work, by far the major portion of the fund is coming from our company members. The responses have been very gratifying, both from companies who were solicited prior to the general announcement to members in Letter Circular No. 265, and from many companies who have responded as a result of that announcement.

Naturally large contributions are not expected from personal members, but it is hoped that each one will take a personal interest in the Headquarters. Personal contributions in amounts ranging from $1 to $100 are being received. No matter what the amount, a contribution will be welcomed as evidence of the interest in and the desire to support the Headquarters project.

1946 Meetings?

AT ITS quarterly meeting in New York in June, the Executive Committee decided to plan for meetings in 1946, even though there is no assurance that the war with the Japanese will have reached the stage where the load on the railroads and other facilities will permit a gathering such as A.S.T.M. usually has. At any rate, this matter will be followed closely, and the members kept advised through the BULLETIN. The Spring Meeting is again scheduled for Pittsburgh from February 25 to March 1, 1946, and the Annual Meeting again for Buffalo throughout the week of June 24. It is planned, if the Annual Meeting is held in Buffalo, to have the exhibit of testing apparatus and related equipment. By these actions the Executive Committee is renewing its

plans originally scheduled for 1945.

Concerning meetings of technical committees and district committees, members of the respective committees and groups are posted in advance and, in so far as possible, the BULLETIN will carry schedules of such meetings.

From the Steps of the New Headquarters Building Looking North Across Logan Square.

Public Library on the right; Franklin Institute (steps) visible on the left.

Numerous Actions on Standards; Changes in By-laws Submitted to Members for Letter Vote

BY ACTION of the Forty-eighth Annual Meeting, 82 recommendations from standing committees were approved for submission to letter ballot of the Society membership. These recommendations cover 43 tentative standards proposed for adoption as standard and the adoption as standard of 39 revisions in existing standards.

In connection with this detail of standardization procedure, it should be noted that only by letter ballot of the entire Society membership can changes be made in the formal standards. The action of an annual meeting session, or in the interval between annual meetings Committee E-10 on Standards, can approve for publication as *tentative* proposed new standards, can approve *revisions in tentative standards* (which are incorporated immediately), or can take action to permit publication as *tentative* of *proposed revisions in standards*. Many such actions, of course, are taken at the Annual Meeting and throughout the year by Committee E-10.

A complete list of the items to be voted upon appears in the letter ballot being sent in a separate mailing to the members. Detailed information concerning most matters referred to letter ballot is given in the committee reports issued in preprint form to the membership in advance of the meeting. The *Summary of Proceedings* accompanying the letter ballot contains a record of all actions taken at the annual meeting and also gives in full detail any changes in or additions to the standing committee recommendations as preprinted.

The ballot will be canvassed in September at which time all items receiving a favorable vote become effective.

All new and revised standards and tentatives on which action was taken during 1945 will be published in the 1945 Supplement to the 1944 Book of A.S.T.M. Standards. Meanwhile, many of the items will appear in various special compilations of standards relating to specific industries and for the most part all will be available in separate pamphlet form.

New Prize Award Established by R. L. Templin

THROUGH the interest and generosity of R. L. Templin, Assistance Director of Research and Chief Engineer of Tests, Aluminum Company of America, there has been established a prize award for papers describing new test methods and apparatus. The award will consist of a cash prize of $25 and a suitably engrossed certificate. Mr. Templin has contributed $1000 as the principal of the Award Fund.

The aim of this award as conceived by Mr. Templin is to stimulate research in the development of testing methods and apparatus, encourage the presentation to the Society of papers describing new and useful testing procedures and apparatus, and recognize meritorious efforts of this kind. General rules and details of the award appear below, as developed by a special committee, appointed by the Executive Committee, consisting of Messrs. C. L. Warwick, Chairman, J. C. Geneisse, and F. G. Tatnall.

Mr. Templin's Interest in A.S.T.M.:

In addition to the preparation of an extensive series of technical papers as noted below, Mr. Templin is very active in several A.S.T.M. technical committees, including the Research Committee on Fatigue of Metals and Committee E-1 on Methods of Testing; he served as a member of the Executive Committee from 1937 to 1939. As all who are acquainted with him know, he is greatly interested in testing and research equipment and his testing laboratory at the Aluminum Company is one of the finest.

His many technical papers pre-

sented at A.S.T.M. meetings also show his interest in this field, and beginning in 1926 and for several years, he had a paper at each annual meeting. These have involved a variety of subjects. In addition to his notable contribution as an author, he has served the Society as a reviewer of technical papers and has aided many authors with constructive comments. Each of his papers has been splendidly prepared and it is of interest that he was awarded the Charles B. Dudley Medal for his 1933 paper covering "Fatigue Properties of Light Metals and Alloys."

Now Three Awards:

With the institution of the Richard L. Templin Award, there are three honors which have been established to recognize outstanding technical contributions. The Charles B. Dudley Medal established in 1925 is given to the author or authors of papers of outstanding merit constituting an original contribution on research in engineering materials. This medal was established by voluntary subscriptions from members of the Society. In 1938 Committee C-9 on Concrete and Concrete Aggregates established an award in honor of its first chairman, Sanford E. Thompson, to be given to the author or authors of the papers of outstanding merit on concrete and concrete aggregates presented at annual meetings of the Society.

Rules of the Award:

The report of the Award Committee as accepted by the Executive Committee and approved by Mr. Templin embodies:

1. That the Award be designated as the Richard L. Templin Award, established for the purposes of stimulating research in the development of testing methods and apparatus, encouraging the presentation to the Society of papers describing new and useful testing procedures and apparatus, and recognizing meritorious efforts of this kind.
2. That the award be a cash prize of $25 and a suitable certificate.
3. That papers to be eligible for the award shall have been accepted for publication in their entirety by the Society, shall be the *bona fide* production of those who contribute them and shall not have been previously made public nor contributed elsewhere in whole or in part. The following are included among eligible papers: (a) Papers accepted by Committee E-6 on Papers and Publications for any meeting of the Society, including papers to be presented as part of committee reports; (b) papers presented at meetings of committees of the Society accepted by Committee E-6; and (c) papers accepted by Committee E-6 for publication in the ASTM BULLETIN.
4. That papers be reviewed annually for this award by a committee of three members of the Society, appointed by the Executive Committee not later than October, the first year as follows: One member for a term of one year, one for a term of two years, and one for a term of three years; in the following year and thereafter, one member for a term of three years. The chairman of the committee in any year shall be the member who retires from the committee at the end of that year. Members of the Committee on Papers and Publications shall not serve as members of the Committee on Award.
5. That the Committee on Award constituted after October of each year consider all eligible papers presented at meetings in that year or published in the BULLETIN of that year; that the award be made at the annual meeting in the following year; and that the Committee's selection of the paper to receive the award be reported to the Executive Committee not later than the April preceding said annual meeting; and that the author or authors of the paper selected for the award shall be notified by the Executive Committee.
6. That if, in the opinion of the Committee on Award, none of the papers under consideration is worthy of the award, no award shall be made for that year.
7. That in the case of co-authors of an award paper, each author shall receive a certificate and the cash prize shall be equitably divided between the authors.
8. That the Executive Committee shall have final authority in the management of the funds involved, as well as authority to decide any question not specifically covered in the above recommendations and to make such modifications thereof as it may deem desirable; and finally
9. That in the event that this Award shall for any reason be discontinued, the remainder of the principal of the fund shall be added to the principal of the A.S.T.M. Research Fund.

National Research Council Activities

DURING the war period, the work sponsored by the Division of Engineering and Industrial Research of the National Research Council has zoomed to huge proportions involving the expenditure of many millions of dollars. Some indication of current work is given in the Division's Annual Report. Robert J. Moore, Bakelite Corp., New York, represents the Society on this NRC Division.

The Highway Research Board, one of the Division's units, has been very active, particularly on problems resulting from the forced use of unusual or inferior materials in the construction and maintenance of highways. Several bulletins on war-time road problems have been issued. A special project on the use of calcium chloride in soil stabilization is under way, and another project relating to the compaction of subgrade earth as a foundation for airplane landing fields has been referred to the Division by the Research Board for National Security (RBNS).

The Division's largest activity involves the work of the War Metallurgy Committee which, however, has transferred a number of its projects from the Office of Scientific Research and Development (OSRD) to the Office of Production Research and Development (OPRD). Almost 900 reports have been prepared, many resulting from research projects carried out. During the past year, work has involved weldability quality of steels for hull construction, metals for jet propulsion devices, aluminum alloys, etc. (One report on Standard Samples for Spectrographic Analysis has been published by the Society and publication of another involving impact properties of metals at low temperatures is scheduled.)

Concerning Quartermaster problems, here the work has been of great volume and much importance concerning the improvements of fabrics for war issue. Great savings resulted from one study on the preshrinkage of woolen fabrics. Projects carried out through this committee have concerned permanent sizing of warps, improvement of shoes, impregnated clothing, flameproofing, and protection of Quartermaster stores. Recently the prime contract for this work has been transferred from OSRD to the Office of the Quartermaster General.

The Division's Annual Report also refers to work on fatigue in industry, surplus war properties, patent policies and work on prosthetic devices, the latter, relating to artificial limbs, will be of great value to the vastly greater and continuing number of those suffering from accidents in industry and private life generally.

List with Serial Designations of New and Extensively Revised Tentative Standards

THE Society, through Committee E-10 on Standards, as detailed earlier in this BULLETIN, has accepted 39 new tentatives, and 43 existing tentative specifications and test methods have been revised. Of the latter, a number were extensively changed and the titles of these are given below (marked with an asterisk) with a list of those issued by the Society for the first time. Standing committees responsible for the various items are indicated in italics.

New and Revised Tentatives

Non-Ferrous Metals and Alloys

(Committee B-5)

Specifications:

Beryllium-Copper Alloy Strip (B 194 – 45 T).
Beryllium-Copper Alloy Strip, Special Grade (B 195 – 45 T).
Beryllium-Copper Alloy Rod and Bar (B 196 – 45 T).
Beryllium-Copper Alloy Wire (B 197 – 45 T).
Copper-Silicon and Copper-Silicon-Zinc Alloy Sand Castings (B 198 – 45 T).

(Committee B-7)

Magnesium-Base Alloy Permanent Mold Castings (B 199 – 45 T).

Lime

(Committee C-7)

Method:

*Physical Testing of Quicklime and Hydrated Lime (C 110 – 45 T).

Petroleum Products, Paper, Electrical Insulating Materials, Rubber

(Committee D-2)

Method:

Analysis of Petroleum Sulfonates (D 855 – 45 T).

(Committee D-6)

Methods:

Test for Absorption by Bibulous Papers of Water and Writing Ink (D 824 – 45 T).
Test for Ply Adhesion of Paper or Vulcanized Fibre (D 825 – 45 T).
Test for Degree of Wet Curl of Paper (D 826 – 45 T).
Test for Edge Tearing Strength of Paper (D 827 – 45 T).
Test for Tensile Breaking Strength of Paper and Paper Products (D 828 – 45 T).
Test for Wet Tensile Breaking Strength of Paper and Paper Products (D 829 – 45 T).
Test for Water Vapor Permeability of Sheet Materials at Elevated Temperature and Humidity (D 830 – 45 T).

(Committee D-9)

Specifications:

*Natural Block Mica and Mica Films Suitable for Use in Fixed Mica-Dielectric Capacitors (D 748 – 45 T).

Methods:

*Testing Molded Materials Used for Electrical Insulation (D 48 – 45 T).
*Conditioning Plastics and Electrical Insulating Materials for Testing (D 618 – 45 T), issued jointly with Committee D-20.
Test for Gas Content of Insulating Oils (D 831 – 45 T).

(Committee D-11)

Specifications:

Natural Rubber Cups for Use in Hydraulic Actuating Cylinders (D 818 – 45 T).

Methods:

Identification and Quantitative Analysis of Synthetic Elastomers (D 833 – 45 T).

Recommended Practice:

Conditioning of Rubber and Plastic Materials for Low-Temperature Testing (D 832 – 45 T).

Industrial Aromatic Hydrocarbons

(Committee D-16)

Specifications:

Nitration Grade Benzene (D 835 – 45 T).
Industrial Grade Benzene (D 836 – 45 T).
Industrial 90 Benzene (D 837 – 45 T).
Refined Solvent Naphtha (D 838 – 45 T).
Crude Light Solvent Naphtha (D 839 – 45 T).
Crude Heavy Solvent Naphtha (D 840 – 45 T).
Nitration Grade Toluene (D 841 – 45 T).
Industrial Grade Toluene (D 842 – 45 T).
Nitration Grade Xylene (D 843 – 45 T).
Industrial Grade Xylene (D 844 – 45 T).
Five-Degree Xylene (D 845 – 45 T).
Ten-Degree Xylene (D 846 – 45 T).

Methods:

Test for Acidity of Benzene, Toluene, Xylenes, and Similar Industrial Aromatic Hydrocarbons (D 847 – 45 T).
Test for Acid Wash Color of Benzene, Toluene, Xylenes, and Similar Industrial Aromatic Hydrocarbons (D 848 – 45 T).
Copper Corrosion Test of Industrial Aromatic Hydrocarbons (D 849 – 45 T).
Test for Distillation of Industrial Aromatic Hydrocarbons (D 850 – 45 T).
Test for Paraffins in Industrial Aromatic Hydrocarbons (D 851 – 45 T).
Test for Solidifying Point of Benzene (D 852 – 45 T).
Test for Specific Gravity, Color, and Hydrogen Sulfide and Sulfur Dioxide Content (Qualitative) of Industrial Aromatic Hydrocarbons (D 853 – 45 T).

Soils for Engineering Purposes, Plastics

(Committee D-18)

Method:

Test for Specific Gravity of Soils (D 854 – 45 T).

(Committee D-20)

Specifications:

*Cellulose Acetate Plastic Sheets (D 786 – 45 T).

Methods:

*Conditioning Plastics and Electrical Insulating Materials for Testing (D 618 – 45 T).
*Test for Haze of Transparent Plastics by Photoelectric Cell (D 672 – 45 T).
Test for Ammonia in Phenol-Formaldehyde Molded Materials (D 834 – 45 T).

Activities in Committee D-10 on Shipping Containers

WITH some minor editorial changes, two proposed test methods covering the drop test and the compression test for shipping containers will be submitted to Committee E-10 on Standards for approval and publication, either as complete new tentatives or as revisions of existing Methods D 775 and D 642, previously issued through the work of Committee D-6 on Paper and Paper Products. The tests are intended for a much wider range of containers than fiberboard which were covered by Committee D-6 methods.

Changes in the proposed drum test which will clarify the size of the containers that should be run in the 7-ft. diameter drum are to be balloted on, and following favorable vote this will be referred to the Society. It will include latest detained drawings of the drums, both the 7-ft. and the 14-ft. size, so that there will be no question about the construction, including the location of the baffles. This test, too, will be applicable to wire-bound, wooden and other types of boxes and crates, as well as fiberboard to which the present Committee D-6 method D 782 is confined.

At a conference of the officers of Committees D-6 and D-10, it was mutually agreed that Committee

The 14-ft. drum used for testing loaded containers–a standardized test now being drafted in Committee D-10. Shelves in background have cannisters with various loads to be used in packing the containers.

D-10 work on complete shipping containers and interior packing with a distinct understanding that Committee D-6 and other standing committees should be responsible for work on paper and fiberboard, steel sheets, plywood, and other materials which might enter into the construction of a shipping container.

The several D-10 subcommittees have various projects under way. The group on definitions is considering a clear description of the term "shipping container," and there are a whole host of terms which will be studied. One of the problems is to select terms which can be defined technically and for which there is a need in the industry. The subcommittee working on procedures for moisture and water vapor resistance have drafts under study. There are numerous problems in this field which need evaluation before a standardized procedure can be recommended. Here, too, there is an urgent demand for standards.

Although the subcommittee concerned with performance standards which will ultimately recommend specification requirements must await perfection of various tests, it nevertheless will undertake to get its work under way. It is important to note just what significance attaches to the fact that a container will withstand so many revolutions in the drum test, for example.

The subcommittee on test methods, in addition to current tests being studied for the Conbur inclined plane test, will establish small sections to draft standardized procedures to evaluate bags and sacks; metal drums, barrels, and pails; wooden barrels and kegs; fiber, plywood and fiberboard drums and tubes; wood, wire-bound and fiberboard boxes and cleated cases; and sheathed crates.

The subcommittee concerned with interior packing wil' study the Goss apparatus which has been developed to give some evaluation of packing, including measurements of its cushioning and resistance properties.

Work of Committee E-2 on Spectrographic Analysis

AMONG the numerous matters discussed and acted on at the morning and afternoon meetings of Committee E-2 on Spectrographic Analysis held in New York on June 27 was a symposium on fundamentals of discharge phenomena and excitation, to be held at the next meeting in conjunction with a national meeting of the Society. A committee consisting of E. B. Ashcraft, G. H. Dieke, and Jacob Sherman will arrange details of the symposium.

'Each of the divisions operating under Subcommittee III on Quantitative Methods and Applications reported. The group concerned with copper and nickel and their alloys reiterated the difficulty of establishing procedures for copper alloys because of lack of satisfactory standards and a general form for establishing methods, but will investigate a potential source of standard alloys. In the tin and lead field, it was noted that the Bureau of Standards with the cooperation of the American Smelting and Refining Co. will prepare tin base alloy standards. Although not in A.S.-T.M. form, methods for analyzing aluminum and magnesium alloys are available and a study has been made of procedures for beryllium. Because of the variety of techniques in use for steel, the committee will not attempt to draft a standardized procedure here. Some steel standard samples are available.

After noting with regret the deaths of three of its active members, C. H. Davis, L. R. van Wert, and T. A. Wright (see back portion of this BULLETIN), the committee appointed a successor to T. A. Wright as Chairman of Subcommittee V on Standards and Pure Materials, selecting Dr. R. H. Bell, Vice-President of Lucius Pitkin, one of Mr. Wright's associates. Succeeding Mr. Wright as Vice-Chairman is B. F. Scribner, National Bureau of Standards.

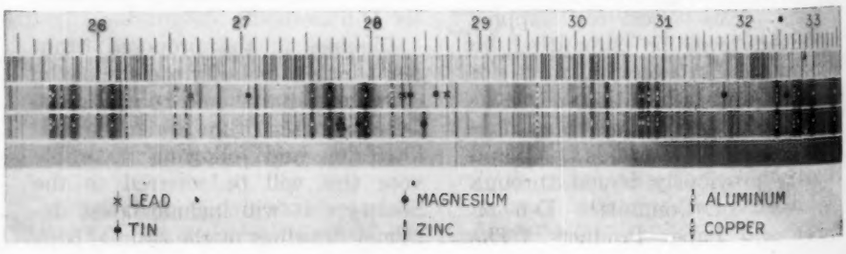
There was a discussion of publishing material compiled at the Bureau by Messrs. Meggers and Scribner bringing the Index to Literature on Spectrochemical Analysis up to date to 1944, and the committee is desirous that this be published including abstracts of each reference if feasible.

One of the interesting parts of the meeting was a report by Dr. G. H. Dieke of Johns Hopkins University on fundamental methods in spectroscopic analysis. It is expected that copies of his report will be distributed to members of Committee E-2.

The meetings were conducted by Committee Chairman H. V. Churchill, with Dr. Mary E. Warga, Secretary, assisting.

Spectra of two die casting alloys. The lower is good quality; the upper failed in service. Note presence of excessive amounts of lead and tin and absence of magnesium in the poor alloy. Top and bottom spectra are of iron and graphite electrodes respectively, without alloy samples.

Cut courtesy Bausch & Lomb Optical Co.



Committee on Electrical Resistance Alloys

COMMITTEE B-4 and its subcommittees held a three-day meeting in Atlantic City, June 13 to 15, at which important progress was reported in various aspects of the committee's activities.

Subcommittee VIII on Metallic Materials for Radio Tubes and Incandescent Lamps met in three sessions, taking action on numerous specifications. Minor revisions were recommended in the four following tentatives under the jurisdiction of this subcommittee:

Methods of Testing:
B 155 – 41 T. Temper of Strip and Sheet Metals for Electronic Devices (Spring-Back Method),
B 157 – 41 T. Wire for Supports Used in Electronic Devices and Lamps,
B 175 – 42 T. Specifications for Round Nickel Wire for Lamps and Electronic Devices, and
B 180 – 43 T. Density of Fine Wire and Ribbon for Electronic Devices.

The subcommittee also reviewed three new tentative methods which are now completed so far as the subcommittee is concerned and will be referred to letter ballot of Committee B-4, and if favorably acted upon submitted to Committee E-10 on Standards this fall. These new methods will provide tests for:

Determining Presence of Surface Flaws in Tungsten Rod or Wire
Welded Lead Wires for Electron Devices and Lamps, and
Determination of Wire Diameter by Weighing.

Chairman S. A. Standing of the subcommittee was particularly gratified with the report received from R. L. Nelms of the progress made by the newly organized sections of his committee on cathode leads and tubing. The four sub-sections of this group have all been active. These four groups are the Committee on the Presentation of Data; the Chemical Analysis Committee; the Metallurgy Committee; and the Diode Committee. The work outlined and under way in each of these groups promises a very active and constructive year.

Other items pending for future work in Subcommittee VIII are the preparation of a report describing a test for evaluating magnetic permeability of materials which are only slightly magnetic, and the preparation of a new test method for checking expansivity and low temperature transformation of certain sealing alloys. Another small group will examine the advisability of preparing specifications on alloy and plated wires.

Subcommittee X on Contact Materials considered the proposed standard dimensions of composite contact tipped screws and studs for silver and silver base contacts. While much progress has been made in the preparation of these standards, it developed that there are still some items on which there was not yet agreement and this work will be carried on during the next year, during which full agreement should be reached. This subcommittee is also working on standard dimensions for refractory contacts. With some minor changes these specifications will also probably be completed during the current year.

One section of Subcommittee X is carrying on tests of the welding tendency of contacts. Five cooperating companies now have machines standardized on which the welding characteristics of silver, copper and nickel contacts can be tested for a report at the next meeting. Another section has prepared a new tentative method of test for determining hardness of contact materials. This will be submitted to Committee E-1 on Methods of Testing for review and then to Committee B-4 for letter ballot.

Subcommittee V on Wrought and Cast Alloys for High-Temperature Use agreed on a bibliographical appendix for Specifications B 190 – 44 T covering chromium-nickel-iron alloy castings (25-12 class). Excellent progress was also made in the draft of the proposed tentative specifications for nickel-chromium-iron alloy castings (35-15 class) which by the next meeting of the committee should be in a form ready for submission to letter ballot by the whole committee.

Subcommittee II on Electrical Tests at its meeting reviewed the five methods of test under its jurisdiction, recommending that four of them as listed below be changed in minor detail and continued as standard. These four, changes to which were approved for reference to A.S.T.M. letter ballot are as follows:

B 70–39. Change of Resistance with Temperature of Metallic Materials for Electrical Heating,
B 77–33. Thermoelectric Power of Electrical-Resistance Alloys,
B 84–36. Temperature-Resistance Constants of Alloy Wires for Precision Resistors, and
B 114–39. Temperature-Resistance Constants of Sheet Materials for Shunts and Precision Resistors.

It was also noted that Method B 63–36 for Resistivity of Metallic Materials was in need of some slight revision, but this was not done immediately as it appeared that there should be a correlation worked out between this method and Method B 193 - 44 T for Resistivity of Copper and Copper-Alloy Electric Conductors which is under the jurisdiction of Committee B-1. A small subcommittee representing the three interested committees, B-1, B-4, and B-5, is now studying this question.

Subcommittee VII on Thermostat Metals also met to consider reports on the modified design for testing equipment for determining yield stress on helical test specimens.

Meetings of the main committee and of the Advisory Committee with Chairman Dean Harvey presiding were held.

A.S.T.M. Cement Test Used on Iron Powders

H. H. Steinour of the Portland Cement Association in the May 17 issue of *Iron Age* describes the use of the Wagner turbidimeter method, A.S.T.M. designation C 115 – 42, for particle size analysis of five commercial iron powders. This work, carried out for the OPRD indicated that for practical purposes the Wagner turbidimeter can be used to good advantage for subsieve analysis of many commercial iron powders. A few easily made changes adapt the procedure of C 114 – 42 to this application. Conformity to the general plan of the standard involves use of a figure for the sedimentation diameter corresponding to 325 sieve size, which for portland cement is taken as 60 microns; corresponding values established for the iron powders are in some cases distinctly smaller.

The air permeability method of determining specific surface also appears feasible for use with iron powders according to Mr. Steinour. It does not, however, provide a size analysis.

District Committee Personnel

APPROXIMATELY one third of the membership terms of the district committees expire each year, this staggering plan thus providing for the renewal or reappointment of a number of members each year.

Following the plan of preceding years, the list of personnel which follows gives the officers of the districts and indicates the appointments for terms which expired with the Annual Meeting in June. The complete personnel of the district committees and other pertinent information will appear in the 1945 Year Book, now in preparation. This lists all officers, current and past, of each district.

The Executive Committee feels that to an increasing extent the districts will assume a more important place in A.S.T.M. work and it is for that reason that the Administrative Committee on District Activities as announced in the May BULLETIN was appointed.

A list, with some details, of important meetings sponsored by the districts was included in the current Executive Committee report and it is interesting after a year's operations to note the considerable amount of technical material that has been presented at meetings sponsored by the districts. Through the district committee members the Society also participates in the activities of technical societies councils and affiliated engineering groups where they have been organized.

Chicago

Officers: J. F. Calef, Chairman, Automatic Electric Co., 1033 Van Buren St., Chicago 7, Ill.; J. de N. Macomb, Vice-Chairman, Inland Steel Co., 1276 First National Bank Bldg., Chicago 3, Ill.; J. J. Kanter, Secretary, Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

Appointments: E. E. Chapman, Atchison, Topeka & Santa Fé Ry.; H. B. Emerson, Lehigh Portland Cement Co.; J. J. Kanter, Crane Co.; L. A. Mekler,* Illinois Institute of Technology; C. A. Menzel,* Portland Cement Assn.; H. H. Morgan, Robert W. Hunt Co.; F. A. Randall, Consulting Structural Engineer; C. C. Zeigler, Swift and Co.

Cleveland

Officers: Arthur J. Tuscany, Chairman, Metal Lath Manufacturers Assn., Engineers Bldg., Cleveland 14, Ohio; Arthur W. Carpenter, Vice-Chairman, The B. F. Goodrich Co., Akron 11, Ohio; R. T. Bayless, Secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Appointments: Arthur W. Carpenter, The B. F. Goodrich Co.; H. J. L. Cotton, Sherwin-Williams Co.; C. P. Engelsman,* Glidden Co.; H. P. Ferguson,* Standard Oil Co. (Ohio); R. L. Wilson,* Timken Steel & Tube Div., Timken Roller Bearing Co.

Detroit

Officers: Martin Castricum, Chairman, United States Rubber Co., 6600 E. Jefferson Ave., Detroit 32, Mich.; W. P. Putnam, Vice-Chairman, The Detroit Testing Laboratory, 554 Bagley Ave., Detroit 26, Mich.; V. M. Darsey, Secretary, Parker Rust-Proof Co., 2177 E. Milwaukee Ave., Detroit 11, Mich.

Appointments: Sydney Bevin, Fiske Brothers Refining Co. (Toledo); Martin Castricum, United States Rubber Co.; W. C. Du Comb, W. C. Du Comb Co., Inc.; C. M. Gambrill,* Ethyl Corp.; W. S. James,* Ford Motor Co.; J. Musser Miller,* Standard Oil Co., (Ind.); H. C. Mougey, General Motors Corp.; E. W. Upham, Chrysler Corp.; F. P. Zimmerli, Barnes-Gibson-Raymond Div., Associated Spring Corp.

New York

Officers: M. P. Davis, Chairman, Otis Elevator Co., 44 Wells Ave., Yonkers 1, N. Y.; E. A. Snyder, Vice-Chairman, Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y.; G. O. Hiers, Secretary, National Lead Co., 105 York St., Brooklyn 1, N. Y.

Appointments: H. C. R. Carlson, Lee Spring Co.; H. G. Farmer, Universal Atlas Cement Co.; G. O. Hiers, National Lead Co.; C. A. Lunn, Consolidated Edison Co. of New York, Inc.; E. P. Pitman, Port of New York Authority.

Northern California

Officers: Dozier Finley, Chairman, The Paraffine Cos., Inc., San Francisco 19, Calif.; M. C. Poulsen, Vice-Chairman, Port Costa Brick Works, Sixth and Berry Sts., San Francisco 7, Calif.; P. V. Garin, Secretary, Southern Pacific Co., 65 Market St., San Francisco 5, Calif.

Appointments: R. O. Brosemer,* General Electric Co.; A. W. Copley,* Westinghouse Electric Corp.; Dozier Finley, The Paraffine Cos., Inc.; G. H. Raitt, Steel Tank & Pipe Co. of Calif.; J. B. Terry (Retired), Standard Oil Co. of Calif.; H. A. Williams, Stanford University.

Philadelphia

Officers: L. E. Ekholm, Chairman, Alan Wood Steel Co., Conshohocken, Pa.; J. F. Vogdes, Jr., Vice-Chairman, Philadelphia Committee, Pennsylvania Economy League, 919 Broad Street Station Bldg., Philadelphia 3, Pa.; R. W. Orr, Secretary, RCA Victor Division of Radio Corp. of America, Camden, N. J.

Appointments: Alexander Foster, Jr., Warner Co.; H. M. Hancock, Atlantic Refining Co.; G. H. Mains, National Vulcanized Fibre Co.; R. W. Orr, RCA Victor Div., Radio Corporation of America; F. G. Tatnall, Baldwin-Southwark Div., Baldwin Locomotive Works.

Pittsburgh

Officers: Thomas Spooner, Chairman, Westinghouse Electric Corp., East Pittsburgh, Pa.; J. J. Shuman, Vice-Chairman, Jones & Laughlin Steel Corp., Pittsburgh 30, Pa.; P. G. McVetty, Secretary, Westinghouse Electric Corp., East Pittsburgh, Pa.

Appointments: M. D. Baker, West Penn Power Co.; Max Hecht, Adviser, Power Stations Chemistry; F. M. Howell, Aluminum Company of America; W. A. Selvig, U. S. Bureau of Mines; J. J. Shuman, Jones & Laughlin Steel Corp.; E. C. Wright, National Tube Co.; M. C. Wylie, Gulick-Henderson Co., Inc.

St. Louis

Officers: Hermann von Schrenk, Chairman, Consulting Timber Engineer, Tower Grove and Flad Aves., St. Louis 10, Mo.; E. J. Russell, Vice-Chairman, Mauran, Russell, Crowell & Mullgardt, 1620 Chemical Bldg., St. Louis 1, Mo.; L. A. Wagner, Secretary, Missouri Portland Cement Co., 9403 Riverview Dr., St. Louis 15, Mo.

Appointments: K. R. Fox, Monsanto Chemical Co.; G. L. Oliensis, Babbitt-Barber Asphalt Products, Inc.; E. J. Russell, Mauran, Russell, Crowell & Mullgardt; H. E. Wiedemann, Consulting Chemist.

Southern California

Officers: E. O. Slater, Chairman, Smith-Emery Co., 920 Santee St., Los Angeles 15, Calif.; H. E. Jung, Vice-Chairman, Southern California Edison Co., Ltd., Edison Bldg., Los Angeles 53, Calif.; H. W. Jewell, Secretary, Pacific Clay Products, 306 West Ave. 26, Los Angeles 31, Calif.

Appointments: F. J. Converse, California Institute of Technology; W. C. Hanna, California Portland Cement Co.; R. H. Pierson, U. S. Naval Drydocks; L. P. Spalding,* North American Aviation Inc.; R. B. Stringfield, Consolidated Vultee Aircraft Corp.

Western New York—Ontario District

Officers: B. L. McCarthy, Chairman, Wickwire Spencer Steel Co., Station B, Buffalo 7, N. Y.; O. W. Ellis, Vice-Chairman, Ontario Research Foundation, 43 Queen's Park, Toronto 5, Ont., Canada; I. C. Matthews, Vice-Chairman, Research Labs., Eastman Kodak Co., Rochester 4, N. Y.; T. L. Mayer, Secretary, Department of Technology, Buffalo Public Library, Buffalo 3, N. Y.

Appointments: T. J. Brown, Canisius College; C. W. Georgi,* Quaker State Oil Refining Co.; R. A. Kundinger,* Dominion Rubber Co.; I. C Matthews, Eastman Kodak Co.; T. L. Mayer, Buffalo Public Library; O. M. O'Neill, Niagara Alkali Co.

* Indicates new appointment.

Chicago District Active in Council

THE CHICAGO District of the Society is participating actively in the work of the Chicago Technical Societies Council, in which it holds membership. In the July issue of the Council's publication, *Sci-En-Tech News*, John F. Calef, District Chairman, and A.S.T.M. delegate to the Council, has an interesting article on "How Can the Council Serve Its Societies?" He refers to the value of the war production conferences that were sponsored, the development of the *Sci-En-Tech News*, and the forthcoming *Register*, coordinated programs, additional educational activities, and the goal of suitable meeting facilities in a building to be sponsored by the Council.

Science—the Endless Frontier

(Dr. Bush's Report on a Program for Postwar Scientific Research)

THE daily press has carried news accounts of the report to the President by Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, giving recommendations on specific questions raised by President Roosevelt last November. These questions as discussed in detail in Dr. Bush's rather trenchant report of some 34 pages concern the release of information which had been developed during the war effort, questions of organizing work in the medical field, a program for developing scientific talent among the American youth, and finally how can the Government aid research activities by public and private organizations? While members of the Society are concerned with all four questions, they would be particularly interested in the last and they may wish to obtain from the U. S. Government Printing Office in Washington (30 cents) copies of a 184-page report which includes not only Dr. Bush's recommendations but the detailed reports of the several committees of the nation's outstanding authorities who developed the information and data on which the final report was presented.

Items from the Report:

"Science can be effective in the national welfare only as a member of a team, whether the conditions be peace or war. But without scientific progress no amount of achievement in other directions can insure our health, prosperity, and security as a nation in the modern world."

"Military preparedness requires a permanent, independent, civilian-controlled organization, having close liaison with the Army and Navy, but with funds directly from Congress and with the clear power to initiate military research which will supplement and strengthen that carried on directly under the control of the Army and Navy."

"A nation which depends upon others for its new basic scientific knowledge will be slow in its industrial progress and weak in its competitive position in world trade, regardless of its mechanical skill."

"If the colleges, universities, and research institutes are to meet the rapidly increasing demands of industry and Government for new scientific knowledge, their basic research should be strengthened by use of public funds."

"A permanent Science Advisory Board should be created to consult with these scientific bureaus and to advise the executive and legislative branches of Government as to the policies and budgets of Government agencies engaged in scientific research."

"The Internal Revenue Code should be amended to remove present uncertainties in regard to the deductibility of research and development expenditures as current charges against net income."

"The Government should take an active role in promoting the international flow of scientific information."

"Our ability to overcome possible future enemies depends upon scientific advances which will proceed more rapidly with diffusion of knowledge than under a policy of continued restriction of knowledge now in our possession."

"It is recommended that measures which will encourage and facilitate the preparation and publication of reports be adopted forthwith by all agencies, Governmental and private, possessing scientific information released from security control."

Subcommittee Reports:

It is not possible to summarize the various committee reports but some notes may be of interest. The Table of Scientific Research Expenditures and National Income shows that during 1940 with a national income of about 78 billion dollars, which corresponds roughly with the years 1925 and 1930, the total scientific research expenditures in 1940 were over $345,000,000 compared with $166,000,000 in 1930. No figures are given for the total expenditures since 1940, but the rise in Government expenditures is quite marked as is well known, increasing from $69,000,000 in 1940 to $207,000,000, $332,000,000, $562,000,000, and $720,000,000, respectively, for the past four years. National income for 1944 was stated at about 161 billion dollars.

Southern California District Meeting

APPROXIMATELY 150 members and guests of the Southern California District of A.S.T.M. were present at the Rainbow Room, Mayfair Hotel, Los Angeles, May 28, to hear an interesting discussion on Rocket Development as sponsored by the Navy at the California Institute of Technology. A special feature of the evening was the recognition of forty years of membership in the Society of W. C. Hanna of the California Portland Cement Co.

Dr. Frederick C. Lindvall presented the history of the research and field testing involved in developing the rocket into a powerful weapon of offense. Colored motion pictures showed their use by aircraft, landing craft, and jeeps; also ground action from portable launching ways. Materials, inspection and production problems were discussed by Mr. Clarence Weinland. Discussion followed by F. J. Converse of the California Institute of Technology, and C. E. Emmons, The Texas Company, both members of the Southern California District Committee.

The meeting closed after a lengthy period of open discussion.

Sixth Annual Water Conference

THE Sixth Annual Water Conference of the Engineers' Society of Western Pennsylvania (which society this year completes its fortieth year of continuous membership in A.S.T.M.—see short article elsewhere in this BULLETIN on "Forty-Year Members") is to be held at the Hotel William Penn, Pittsburgh, Pa., October 22 and 23, 1945. Many A.S.T.M. members are concerned with the excellent papers presented at these conferences and a number have taken part in the program. Further details of the conference can be obtained from H. M. Olson, General Chairman, at the Hotel William Penn, Pittsburgh, Pa.

Standard Steel's Sesqui-Centennial

THIS year the Standard Steel Works Division of Baldwin Locomotive Co. which division has been affiliated with the Society since 1902 is celebrating its sesqui-centennial having been founded as Freedom Forge during Washington's second term in 1795. Many of Standard's technical executives have been very active in A.S.T.M. work including a former company Vice-President, A. A. Stevenson, who in the period prior to 1920 aided greatly in the development of the Society, and the present Divisional Vice-President, John D. Tyson, who has been active in the work of Society committees, notably A-1 on Steel.

Many Important Current Activities in Technical Committees Particularly on Standardization

Committee Officers Furnish Interesting Statements of Work

OBVIOUSLY a complete inventory is impossible of the current and projected activities of some sixty standing technical committees each with subcommittees, including sections, ranging in number from five to fifty. The best that can be done is to summarize some of the more interesting projects under way or scheduled to be started and to refer to other sources where information on committee activities is published.

Thus it is the purpose of this article in each August BULLETIN to use in their entirety—or statements excerpted therefrom—committee programs of work which each standing committee is requested to submit to the Staff so that the administrative committees and the officers can be informed of what may lie ahead. This year, many interesting statements have been received from the officers of various committees as will be indicated in the material that follows. In some cases this is supplemented by excerpts from committee reports, but this year there is a minimum of that type of material.

Much of the material relates to research projects, but in so many cases these investigations are aimed to develop information to be incorporated ultimately in specifications and tests and no endeavor has been made to differentiate clearly where research ends and standardization begins.

The material is segregated under appropriate classifications but many readers concerned primarily with one or two fields may find it sufficiently interesting and instructive to peruse the entire article and get some conception of the great amount of work that the Society is carrying on through the activities of its hard-working committees.

Committee A-1 on Steel:

For the past year the steel industry has continued to turn out a heroic tonnage of its products, for many of which the quality and characteristics are covered by standards developed by Committee A-1 on Steel. While it might be said that the committee itself has been marking time, nevertheless there have been a number of meetings of subcommittees and soon the work of many of the groups must be intensified to decide what action should be taken on the large number of emergency alternate provisions and also changes in specifications which will be influenced by a return to peacetime production. Some items more or less active are mentioned here, a few of which will be submitted to the Society in the very near future for action. Standardized requirements for structural steel for welding have been discussed extensively for many months and years. Subcommittee II will take the lead in cooperation with the American Welding Society and the American Iron and Steel Institute in drafting the requirements. There are several items concerning forgings including requirements for stainless material, also revisions in requirements for higher strength forgings. Soon to go to letter ballot vote in the main committee are revised specifications for steel castings involving a streamlining and simplification of the requirements. Some of the current specifications will eventually be dropped. Affected are castings for general industrial use, including welding, railroads and high-temperature service. Come peace, come war, come almost anything, Subcommittee IX with its large number of items on pipe and tubing always has a docket of matters intended as improvements and to keep specifications in line with commercial practice. The copper brazed tubing specification, A 254, is to be clarified so that suitable design values can be assigned to the different grades of this material. Several electric-resistance welded pipe and tubing specifications have been in the course of intensive study and the differences of opinion are not yet entirely ironed out. In the field of plates and related materials for boilers and pressure vessels, match marking of test specimens, the question of materials that will inhibit graphitization and other problems will be under action before many months. Work has been authorized on new and somewhat revolutionary specifications for heat-treated bar steels that could be purchased and stocked with specified physical and chemical requirements.

Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors:

Committee B-1 has several studies under way including an investigation of the stranding requirements in the specifications for concentric-lay-stranded copper conductors (B 8). A group is to review the requirements for preparing the polysulfide solution specified for the conductivity of coating tests in specifications for tinned copper wire (B 33).

Involving specifications for rope-lay conductors (B 172, B 173), bunch stranded conductors (B 174), and concentric-lay stranded conductors (B 8) are suggested methods of tests for determining agreement of actual areas of cross-sections of completed stranded conductors with those called for in purchase orders, to be formulated by a special group.

Information on suitable edgewise bending equipment necessary in the specifications for soft rectangular and square wire (B 48) is to be assembled so as to be available for all those interested.

Committee C-5 on Fire Tests of Materials and Construction:

Subcommittee I on Specifications for Fire Tests has completed a closer

Statements

covering meetings of several technical committees are published in this BULLETIN and should be referred to in connection with this article, since the news accounts are really supplementary. These include the committees covering Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys, Spectrographic Analysis, Shipping Containers, and Adhesives.

definition of the standard time-temperature curve together with data on the areas under the curve at given time intervals. This is to be presented to the committee.

The committee has also given attention to the development of methods of conducting fire tests of roof construction in so far as these are not covered under specifications for floor constructions. Some modifications of performance requirements have been proposed. As a basis for further work thereon, fire tests of a number of roof constructions were conducted last year in the small floor furnace at the National Bureau of Standards. During the coming few months there will be conducted two fire tests of roof constructions in the large floor furnace that will give additional information.

In the matter of development of specifications for fire tests of ceiling constructions, three fire tests were conducted last year, and during the past few months three tests of representative ceiling constructions have been conducted in the large floor furnace at the National Bureau of Standards. Results of these latter will be circulated to the committee.

Subcommittee II on Fire Tests of Lumber is developing a revision of sampling requirements to be included in A.S.T.M. tentative standard C 160 – 41 T and also of another method of test for fire-retardant properties of wood employing the fire tube equipment. Some research will probably be needed on performance of specimens cut from the surface and interior sections of the treated structural members in order that appropriate sampling requirements may be included for the range of purposes for which the wood is processed.

Subcommittee III on Fire Tests of Wall Opening Protectives is concerned with development of specifications for fire tests of window protectives to replace the proposed specification presented in 1943.

Subcommittee IV on Fire Tests of Acoustical and Similar Finishes is developing data on the performance of acoustical and similar finishes in flame tunnel tests and related tests that indicate the susceptibility to spread of fire over the surface. An analysis has been made of criteria of smoke hazard expressed as light transmission and optical density that will soon be ready for submission to the committee.

The work of the Committee on Definitions has been concerned in considerable part with the definition for an incombustible material and a corresponding definition for a combustible material or materials presenting different degrees of fire hazard or fire-retardant properties. A study was made of the British test for incombustibility together with a modification thereof, results of which were presented to the Society as a paper for the recent annual meeting. This was Preprint No. 50 presented by N. P. Setchkin and S. H. Ingberg, Chairman of Committee C-5, both of the National Bureau of Standards.

Subcommittee VIII on Fire Tests of Roof Coverings has had an organization meeting and is proposing methods of testing and classifications based on those that have been established by the Underwriters' Laboratories. A considerable volume of testing of roof covering materials has been conducted at the National Bureau of Standards which will also be made available to the subcommittee. The results thereof as it concerns classifications is given in Bureau of Standards publication BMS 92, Fire Resistance Classifications of Building Constructions.

Committee C-7 on Lime:

A program of research is being set up by the Subcommittee on Research Problems for round-robin tests on water retentivity tests on limes. Additional tests are also being conducted by this committee on the question of workability, which is to be correlated with committee work now being done by Dr. Fink of the National Bureau of Standards.

The following specifications are ready for letter ballot of the committee:

Specifications for Masons Hydrated Lime
Specifications for Type S Finishing Hydrated Lime
Specifications for Type N Finishing Hydrated Lime

Proposed revisions of Standard Specifications for Normal Finishing Hydrated Lime (C 6) have been drafted. In addition the Master Specifications for Lime for Chemical Purposes is now ready for committee consideration.

Subcommittee V on Methods of Test is working on tests for fluorides in lime.

Committee C-8 on Refractories:

The Subcommittee on Industrial Surveys is supervising revisions of surveys on refractories used in coke ovens, for open-hearth furnaces, and in the lead industry. The two latter revisions have been prepared and are now being reviewed. Two new surveys planned for completion after the war will deal with refractories in steel-mill pouring pits and in the gas industry.

The various test methods that have been issued are being reviewed in order to insure that all equipment is adequately described.

The re-established Section on Load is giving consideration to setting up load test schedules for brick not now covered, particularly silica and various basic and neutral products.

Standardization of cone 32½ at the National Bureau of Standards is to be undertaken by the Section on Temperature after the war.

The Section on Tests on Refractory Insulation is revising the methods of testing insulating fire brick. The section is also giving attention to a suggestion that the classification of insulating fire brick be extended to include brick to be tested at 2950 F.

The new Section on Tests for Mortars and Plastic Refractories will concentrate on methods of tests for these two refractory products.

Paragraphs on sampling for inclusion in various specifications are being prepared.

A thorough discussion of revised definitions of fire clay and air-setting refractory mortar is scheduled for the next meeting.

A proposed specification relating to the particle size of ground refractory materials is being studied by the Specifications Subcommittee.

The new Subcommittee on Petrography and the new Subcommittee on Special Refractories are organizing programs of work. The latter is to prepare information on methods of test and specifications pertaining to such refractory products as mullite, zircon, basic refractories, and other products.

Committee D-1 on Paint, Varnish, Lacquer, and Related Products:

In the Subcommittee on Drying Oils a study of methods of test which may be used in the evaluation of bodying linseed oil is being made. Work is being conducted on measurement of the drying time of oils.

The subcommittee concerned with bituminous emulsions of minerals is preparing specifications for asphalt base and coal-tar base emulsions and also methods of test for bituminous emulsions.

Methods of test for the solvent power of petroleum hydrocarbon are being developed. Also being developed is a method of test for the determination of evaporation rates and the subcommittee is studying solvent escape and salt retention.

In the extensive and ramified field of accelerated tests the subcommittee is working on the development of apparatus and methods of test for conducting humidity exposure tests of paints. It is developing procedures for cleaning steel panels in preparation for painting. It has also initiated work for alternate immersion and exposure tests and is developing a procedure for the field testing of paint on metals.

A standardized procedure for the measurement of drying time of varnish is being drafted and also under study are methods of tests used in resin specifications.

The Subcommittee on Physical Properties is conducting work on the measurement of film thickness, adhesion and abrasion resistance.

Consideration is being given to establishing a new working group—the resin and lacquer-emulsion field. The committee is considering a revision of tricresyl phosphate specifications and is working on methods of test and specifications for ethyl cellulose and cellulose acetate.

The committee is continuing exposure tests which were started in February, 1944. In this testing program previously painted panels were treated with chemical pretreatments and were repainted.

Committee D-5 on Coal and Coke:

UNDER consideration by Subcommittee XIII on Coal Sampling is the advancement to standard of the Tentative Method of Sampling Coals Classed According to Ash Content (D 492). Such a recommendation is probable this year. Work is in progress on the development of a suitable method for sampling coals for volatile matter determination in connection with city smoke regulations. Another sampling problem before the subcommittee is how best to sample small quantities of coal used in testing small fuel-burning equipment, such as water heaters.

Subcommittee XI on Coal Friability plans to revise the Tentative Method of Drop Shatter Test for Coal (D 440). During the past year the subcommittee recommended the adoption of the Tentative Method of Tumbler Test for Coal (D 441) but decided that more work should be done on the drop shatter test before recommending it for adoption.

In the work on pulverizing characteristics of coal supervised work on coal grindability testing is under way which may lead to revisions of the tentative test for grindability of coal by the Hardgrove-Machine Method (D 409 – 37 T).

Subcommittee XV on Plasticity and Swelling of Coal has under consideration a number of methods for determination of plastic properties, volume changes, and pressures developed during carbonization of coal in the manufacture of coke. These methods were published for information in the appendix to the 1943 annual report of Committee D-5. Some of the methods may be recommended later for publication as tentative standards when more information becomes available as to their value for testing coal for cokemaking.

Committee D-7 on Wood:

With respect to laminated timber, much active development has been under way for the past several years under the sponsorship of the Office of Production Research and Development. Two pilot plants have been sponsored for developing techniques and procedures in the fabrication of laminated wood members of various kinds covering both hardwoods and softwoods. Concurrently, there is under way at the Forest Products Laboratory a series of tests on laminated timbers with the object of developing data for design and specifications. Also, there have been some tests made at the University of Washington to demonstrate the feasibility of treating glued laminated timbers with a wood preservative, and to establish strength properties for treated material. This research is being continued during the coming year and will provide a wealth of data which should be available to Subcommittee II on Laminated Timber in the development of test methods and specifications.

Subcommittee IX on Methods of Testing has had currently under way for some time a number of studies on improved methods. Among the current studies of the subcommittee is one on the shape and form of tension specimens for veneer and plywood, particularly with the thought of determining the possibility of employing smaller specimens and obtaining closer correlation with standards for other materials.

Subcommittee XII on Fire Retardant Wood has under way an active research program covering a comparison of various test methods for evaluating the effectiveness of fire-retardant treatments. Involved is the question of the size of sample in relation to the size of members being treated for commercial use, and the amount of penetration obtained.

Subcommittee IX on Methods of Testing is planning during the current year a substantial revision of Standard D 143 – 27, Methods of Testing Small Clear Specimens of Timber. The changes involve the tension-parallel-to-grain test method and an increase in the amount of material selected for test, primarily with the thought of obtaining additional data on material in the air-dry condition which experience has shown to be desirable.

Committee D-17 on Naval Stores:

Among the projects on which Committee D-17 will work during the coming year are the following:

Rosin.—Further study of methods for acid and saponification number of dark-colored rosin; also method for determining unsaponifiable matter in rosin; further study of methods for determining softening point of rosin. Development of methods for volatile oils in rosin and for oxi-

dation or decomposition products in rosin.

Pine Oil and Dipentene, Tall Oil, and Pine Tar.—A further study and improvement of present tentative methods of test, by means of collaborative work is anticipated.

Rosin Oil.—A start will be made to draft tentative methods for testing rosin oil.

Committee D-20 on Plastics:

Each of the ten subcommittees of the Plastics Committee has an active program under way. Some of the projects are noted here.

Subcommittee I on Strength.—A method for determining the tensile strength of thin film and foil has been developed and work is being done on compression testing of long columns. The influence of the span-depth ratio on tests results in flexural testing is under study. Considerable work on fatigue testing is in progress; methods being evaluated are the rotating beam, the constant amplitude deflection, and the constant force deflection types. The Johnson shear method is being drafted for balloting. Other items being considered are methods for evaluating the strength properties of various types of laminates including the low-pressure glass fiber types and the types consisting of combinations of high and low density materials. Also on the program are the problems of evaluating the bond strengths in laminates and a mandrel type flexability test.

Subcommittee II on Hardness.—Further studies are being made regarding the Rockwell hardness test in an effort to eliminate differences between the A.S.T.M. Method D 785, Federal L-P-406a, and Army-Navy JAN-P-14 methods. Further data involving other loads with the present M and R scale indentors are also being determined. Methods involving indentation, scratching, and falling abrasive are being studied. It is hoped that better methods of testing and better methods of evaluation can be achieved. A method of evaluating blocking resistance of flexible sheeting has been developed.

Subcommittee III on Thermal Properties.—A test for determining cubical expansion is ready for letter ballot. A further revision of the method for determining deformation under load, D 621, is also ready. Work is being continued on the study of flow properties by use of a parallel plate device. Other items under consideration are improvements in the heat distortion method and the development of a method for determining ignition temperature of plastic.

Subcommittee IV on Optical Properties.—Studies are being continued on methods of measuring haze and light transmission. Round-robin tests are in progress involving the use of a recording spectrophotometer and the use of an integrating sphere. A method of test for measuring surface irregularities of plastics to D-20 letter ballot has been completed.

Subcommittee V on Permanence.—The standardization of procedures for operating carbon arc accelerated aging equipment is in process. Also under development is a method for determining the weight loss on heating. Work is being continued on moisture vapor permeability tests and on accelerated service tests. A study of the relationship of the slow recovery of some plastics from the effects of heating or molding on the physical properties is also being made.

Subcommittee VI on Specifications.—A specification for polystyrene sheets, plates, rods, and tubes is being circulated for comments. The subcommittee is cooperating with NEMA in writing a specification covering post-forming laminating materials. A study is being made of the possibilities of combining the specifications for vinyl chloride and vinyl chloride acetate resins. A revision of the cellulose acetate sheet specification concerning flammability of gages under 20 mils has been sent to letter ballot. The work on classification being done in cooperation with SPI is being actively continued.

Subcommittee VII on Analytical.—A method for determining insolubles in polystyrene is almost ready. A round-robin test is being run on a method for determining free phenol and free formaldehyde in phenol-formaldehyde resins. A tentative procedure has been written for the determination of plasticizer, residual solvent, pigment, and filler in cellulose ester plastics and is now being checked. A revision of D 115 on synthetic resin impregnants is being balloted by the subcommittee.

Subcommittee VIII on Research.—Under active consideration are the problems of flow characteristics and impact strength. A formal program on impact testing has been set up. Plans are: (1) to examine the validity of the size and shape relationships demonstrated by Callendar; (2) to study the relationship of the notch to the geometry of the present Izod test; and (3) to study other methods of notching.

Subcommittee X on Definitions, Nomenclature, Significance of Tests.—Under consideration are a number of definitions including those for "plastic," "thermosetting," "thermoplastic," etc. A proposed definition for "plastic" is ready for D-20 letter ballot. A standardized scheme for designation of flow of thermoplastic materials has been drafted. Work is under way on developing a standard system for designating the direction of testing specimens.

Standard Samples of Hydrocarbons and Boron Steels

The National Bureau of Standards has announced that three of its standard samples of hydrocarbons are now certified with respect to values of refractive index and density and one of these, No. 217, also for calorimetric heat of combustion. Since the material certified for calorimetric heat will probably be used in establishing heating values of gasoline and other liquid fuels it is available in a special 50-ml. ampoule in addition to the usual sizes. These samples of hydrocarbons of known high purity have been prepared and certified for use in calibrating spectrometers and other analytical instruments and apparatus in the laboratories of the petroleum, rubber, chemical, and allied industries. Since the first group of 15 samples was announced (*Technical News Bulletin* 324, April, 1944), additional hydrocarbons have been added, so that now 46 samples are available. The purity of each sample is stated in the certificate.

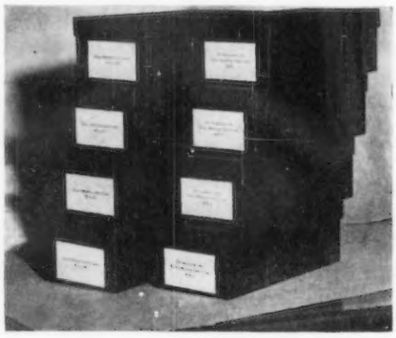
The six samples of boron steels which are now available are in two rod forms for spectrographic work. One rod is $\frac{7}{32}$ in. in diameter. The other 0.5 in. in diameter. Full details on all of the Bureau's standard samples may be obtained by contacting the Bureau's Chemistry Division, Washington 25, D. C.

X-ray Diffraction Data for Chemical Analysis

Extensive Publication Results from International Cooperative Efforts

BECAUSE many of the members and BULLETIN readers are interested in X-ray diffraction work, particularly its tie-in with chemical analysis, information is presented here on a most extensive publication effort sponsored by three groups as enumerated in the March BULLETIN: the American Society for X-ray and Electron Diffraction, the British Institute of Physics, and the A.S.T.M. Originally the project was a joint one with a committee of the National Research Council, but this NRC activity has been taken over by the X-ray group. Believing this to be a case where illustrations speak more effectively than words, we show a photograph of the eight box files, aggregating over eight thousand cards with some explanation of significance of the symbols and a picture of the individual who has "spark plugged" and directed this very extensive project, Professor Wheeler P. Davey, Pennsylvania State College. Professor Davey has not only directed the effort, but all of the preparatory work and correlation of the data have been done under his supervision at Penn State.

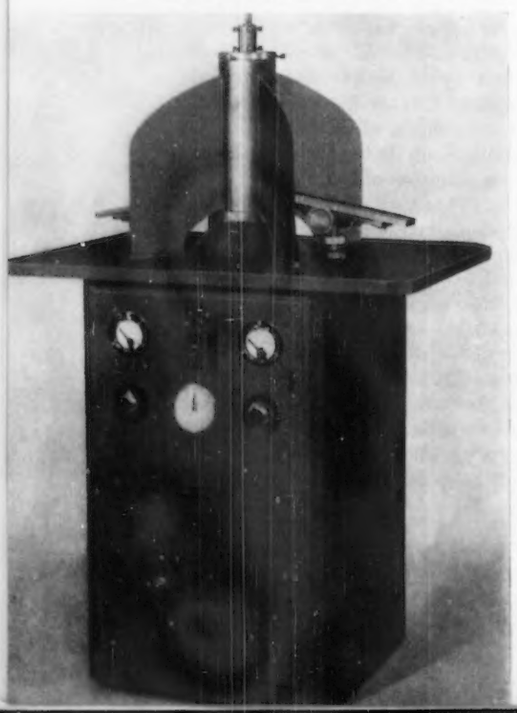
This whole project is a splendid illustration of a research and publication effort where the activities of numerous leaders in the field could best be correlated through a joint committee sponsored by organizations concerned. A.S.T.M. through its Committee E-4 on Metallography, which covers examination of all metallic substances by optical and X-ray diffraction, developed the recommended practice (E 43) for Identification of Crystalline Materials by the Hanawalt X-ray Diffraction Method. This was first published in 1942.



The eight box files comprise the original and supplementary set.

An X-ray Diffraction Machine

Photographs courtesy General Electric X-ray Corp.



While based upon the work of A. W. Hull, the catalog which permits analysis of absolute unknowns was contributed by J. D. Hanawalt, for whom the method is named and the publication of these X-ray diffraction cards is, in a sense, a tribute to Dr. Hanawalt's tremendous contribution to this field. This method determines the interplanar spacings in the crystal corresponding to the three most intense lines in the X-ray diffraction pattern for each of the crystal components of the unknown specimen, and at least an approximate knowledge of the relative intensities of these lines. These data are then compared with a set of reference data. The Hanawalt method of X-ray diffraction gives the state of chemical combination of the compounds present, requires only minute test specimens and, in general, does not require great accuracy of measurement. On the other hand, the method gives no information concerning amorphous phases which may be present, and it may not reveal the presence of solid solutions.

The original card file of some 4000 cards was issued in 1941 covering some 1300 compounds, and the extensive set of some 4500 cards supplementing this has just been completed. The British Institute of Physics has contributed greatly from its extensive investigations. The committee is anxious to compile data on additional compounds. Included in the sets are blank cards for transmitting information to Professor Davey in this country and in England to T. P. Wilson, Cavendish Laboratory, Cambridge.

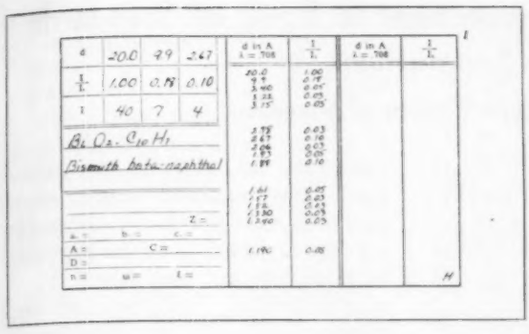
As announced, copies of the original card file are available at $50 per set, shipment prepaid; the charge for the supplementary set being $75.

Index to Cards

An Index, listing *first*, the interplanar spacing giving the strongest line in the diffraction pattern of the substance; *second*, the chemical name of the substance; *third*, its chemical formula; and *fourth*, the serial number of the index card, is furnished to each purchaser of the original set of cards.

A complete cross-referenced Alphabetical Index, covering the cards included in both the original and supplementary set, showing the name of the specimen, its chemical formula and the interplanar spacings for the three strongest lines, is being published and will be furnished

Wheeler P. Davey



This card, number 1 of the whole endeavor—a typical master card—shows in the upper left-hand corner the three strongest lines (20.0, 9.9, and 2.67). The two long vertical columns show all data received by the committee. On this card the identification symbol "H" in the lower right-hand corner indicates it originated with J. P. Hanawalt and his associates at Dow Chemical Co. It will be seen that the chemical symbol is given for the natural mineral or chemical or synthetic compound, or whatever the material may be and its name—in this case bismuth beta-naphthol.

These three cards give diffraction data for the natural mineral labradorite, and it can be seen there is considerable information shown in the vertical columns. Also given is the chemical analysis. In this case the second and third cards which record the second strongest and third strongest lines, respectively, for cross-indexing purposes are shown in addition to the master card. R I (bottom) is the code for technical data which came from Boldyrev (Russian) résumé.

These three cards cover Potassium Sulfate Sulfide 1: 3 and show how supplementary data are recorded in the lower left-hand corner.

Symbols

$a_0 b_0 c_0$ = lattice parameters along the a, b, and c (x, y, z) axes
A = axial ratio = a b
C = axial ratio = c b
D = density
Z = "molecules" per unit cell
n = index of refraction (for isotropic materials)
$\alpha\beta\gamma$ = axial angles
$\alpha\gamma$ = minimum and maximum indices of refraction (for orthorhombic, monoclinic, and triclinic crystals)
β = angle between the a and c axes of anonorthogaonal crystal; especially the interaxial angle of a rhombohedron
ϵ = index of refraction (extraordinary ray for tetragonal, hexagonal, and rhombohedral crystals)
ω = index of refraction (ordinary ray for tetragonal, hexagonal, and rhombohedral crystals).

to all purchasers of the supplementary set of cards. The extent of cross indexing can be illustrated by the case of bismuth potassium silver nitrite. This is listed under "bismuth," "potassium," "silver," and under "nitrite bismuth," "nitrite potassium," and "nitrite silver." This cross indexing should make it easy to locate the three strongest lines of any material for which a single metallic constituent is known or for which the acid radical is known. This not only helps the X-ray diffraction scheme of chemical analysis to tie in schemes for spectrographic analysis but also enables it to tie in with partial qualitative analyses by ordinary "wet" methods.

1945–1946 Publication Schedule Includes Supplement to Book of Standards, Special Compilations and Symposiums

Several Books of Special Interest to Particular Groups of Members

WHILE the publication schedule for the ensuing year, 1945–1946, is not so heavy a one as for the previous year when the complete 1944 Book of A.S.T.M. Standards involving some 6000 pages was issued, nevertheless, the special books and volumes to be issued make an imposing list and together will aggregate several thousand pages of material. In addition to the publications which provide the standard specifications and tests in their latest form, there are several notable technical publications comprising papers presented at various meetings.

Later in the year there will be transmitted to each member a special Members' Order Blank which will list all publications available and note the special prices to members.

Two of the symposiums, the one on stress corrosion cracking and the one on magnetic particle testing, are to be described in detail to the members through prospectuses that will probably be mailed in September.

Regular Publications

1945 Supplement to the Book of Standards:

Following the usual publication plan, there will be issued Supplements to the 1944 Book of A.S.T.M. Standards. These three Supplements to the respective Parts should become available either very late this year, or early next year, and will be distributed to the members on the basis of the Parts of the Book of Standards they have received. At the same time, those who purchased extra copies of the 1944 Books will be advised of the appearance of the Supplements. Each Supplement will bring up to date the corresponding Part of the Book, and it is desirable that those who use the standards have the Supplements readily available. Preliminary estimates indicate that the Supplement to Part I, Metals, will include some 420 pages; Part II, Nonmetallic Materials—Constructional, about 240 pages; Part III, Nonmetallic Materials—General, covering an extensive group of materials, about 600 pages.

Methods of Chemical Analysis of Metals:

Whether there will be a 1945 Volume on A.S.T.M. Methods of Chemical Analysis of Metals, superseding the 1943 issue, and the pamphlet supplements that have been issued, depends somewhat on the progress made in Committee E-3 on Chemical Analysis of Metals with respect to some new procedures, but members will be kept advised. This book will be distributed on the same basis as the previous volume, namely, on request to members.

1945 Year Book:

Includes a list of the complete membership of the Society (name, title, address, company, etc.), the personnel of all A.S.T.M. committees, and other pertinent information. Furnished only to members on request, for use in connection with activities of the Society. Publication date of this 430-page book—about November 1.

1945 Proceedings:

Just how much material will be included in the 1945 *Proceedings* depends upon final conclusions by the Committee on Papers and Publications, but all annual reports of committees either presented in New York on June 27, or progress reports, will be printed as usual, and there will be a great many technical papers. Members will recall that the new plan of publishing papers periodically throughout the year and in the ASTM BULLETIN brings them this material much more promptly than previously. *Proceedings* are intended as a formal repository of all material which is of a permanent reference nature, whether presented at meetings or not. The 1945 *Proceedings* probably will not be available until spring of next year.

1945 Index to Standards and Tentative Standards:

This Index, which continues to increase in value as the number of specifications becomes larger, will again give the latest complete references to publications where the various specifications and test methods appear. The Index is furnished to members and is also widely distributed on request. Publication of the new edition is scheduled for February 1946. This will probably aggregate 230 pages.

Special Compilation of Standards

The tabulation given below of special compilations of standards, several of which include supplementary material relating to the fields covered, should be viewed as an approximate schedule. There are so many factors affecting these books that it is not possible to give any accurate estimation of size or the date that they may become available. The size is affected by committee recommendations which may be coming through the Standards Committee and the date of issue is governed somewhat by editorial considerations, but to a great extent by the tremendous load the printing industry is carrying.

The importance of these special compilations has been stressed, and

Committee Sponsoring	Title	Pages	Approximate Publication Date
B-4	Electrical Heating and Resistance Alloys	190	December
B-5	Copper and Copper Alloys	420	December
C-9	Concrete and Concrete Aggregates	150	August
D-1	Paint, Varnish, Lacquer, and Related Products	470	September
D-2	Petroleum Products and Lubricants	540	October
D-6	Paper and Paper Products	220	January, 1946
D-9	Electrical Insulating Materials	580	September
D-11	Rubber and Rubber-Like Materials	560	January, 1946
D-13	Textile Materials	500	October
D-20	Plastics	580	April, 1946

a significant measure of their value is the continuing widespread distribution each year.

Some new compilations are in prospect, but printing and other considerations make it unlikely that the list will be extended. Should it be, however, members will be kept fully informed.

Special Technical Publications, Symposiums, etc.

1945 Report on Corrosion of Iron and Steel:

The annual report of Committee A-5 on Corrosion of Iron and Steel this year was not printed in advance of the annual meeting since there were no actions on standards, but it is now being set in type and will give the extensive data from the inspection of the many samples of wire and wire products on exposure throughout the country. These data will be of much interest and significance. About 30 pages, the report should be ready in September.

Symposium on Stress-Corrosion Cracking of Metals:

While many of the more than 30 technical papers comprising the Symposium on Stress-Corrosion Cracking of Metals were preprinted in advance of presentation at the three-day series of meetings held in Philadelphia last November under the joint auspices of the A.S.T.M. and the Institute of Metals Division of the A.I.M.E., the complete publication to be issued in October will be a most valuable one giving *all* of the papers and the very extensive discussion. Comprising over 500 pages the book will be available to members of A.S.T.M. and A.I.M.E. in the United States and foreign countries at a price of $5 which will include shipping charges. Full details of the schedule of prices will be given to the members in a prospectus to be mailed soon.

Symposium on Magnetic Particle Testing:

All technical papers and most of the discussion in the Symposium on Magnetic Particle Testing sponsored by the Philadelphia District Committee of the Society at a two-session meeting in January are edited and ready for transmission to the printer, with publication of the 90-page book scheduled for late October. Members will be able to order copies of the symposium book at special prices through a descriptive order blank to be transmitted later.

Report on Behavior of Steels at Low Temperatures:

This publication which may be issued in two parts, aggregating about 200 pages including very extensive tabular and graphic data was prepared by Dr. H. W. Gillett for the War Metallurgy Committee. It covers work carried out under a WPB research contract intended to develop authoritative information on the reactions of various steels at low temperatures. Publication date: About October, 1945, with prices and further details to be announced.

New API Viscosity Standards

The American Petroleum Institute Committee on Viscosity Standards has prepared a new Alpha Oil (Alpha 45) and has recalibrated the Beta and Gamma Oils (Beta 44 and Gamma 44). The official viscosities for these three oils are as follows:

	Alpha 45	Beta 44	Gamma 44
Kinematic Viscosity Centistokes at 100 F.	65.85	375.7	3.030
Centistokes at 210 F.	7.82	23.84	...
Saybolt Universal (by conversion) Seconds at 100 F.	304.3	1736	36.1
Seconds at 210 F.	51.8	114.7	...
Saybolt Furol (by conversion) Seconds at 122 F.	...	85.4	...

The oil standards are available at the following prices:

1 quart, $5.00 f.o.b. Philadelphia
½ pint, $2.50 f.o.b. Philadelphia

Orders for samples should be sent to Dr. T. G. Delbridge, Chairman, 3144 Passyunk Ave., Philadelphia 1, Pa., with check drawn exactly that way.

New Edition 1400-Page Piping Handbook

THE problem of reviewing and decribing adequately a 1400-page publication is indeed staggering and consequently those charged with the task can with propriety resort to certain general references or use various means to appraise the real worth of the publication. Thus in considering the Fourth Edition of the *Piping Handbook* recently issued by the McGraw-Hill Book Co., one immediately notes the author, Sabin Crocker, Senior Engineer, Engineering Division, The Detroit Edison Co., an outstanding authority in this field and a long-time active A.S.T.M. member. Aiding him is an extensive list of collaborators. The book is intended to provide authoritative and acceptable data for those concerned with piping design. It is widely used.

A great many essential standards, specifications, and codes have been abstracted but in view of the increasing number of these, in some cases only references are given. However, Sabin Crocker has admirably succeeded in making the book quite self-contained. The scope of the Fourth Edition has been extended to include chapters on "Gas Piping," "Refrigeration Piping," "Hydraulic Power Transmission Piping," and "Corrosion," which also covers the subject of protective coatings. In addition to this the chapter on "Water-supply Piping" has been considerably augmented, and supplementary material of interest to hydraulic engineers has been added in the section on "Flow of Water in Pipes," which now includes the Scobey, Williams-Hazen, and Kutter-Manning formulas.

Growing interest in the "rational formula" or Reynolds number type of solution for fluid-flow problems has led to an elaboration of this subject.

The latest edition extends the use of tables and charts, provides numerous additional cross references and a more detailed index. Many of the chapters have been revised and augmented, including "Heat Insulation," "Building Heating Systems," "Underground Steam Piping," and "Water-supply Piping."

Any handbook needs a carefully prepared index and it is pertinent to note the 26-page detailed index included, making it convenient to locate desired material quickly.

The book can be obtained in cloth binding, page size 4½ by 7 in. at $7.00 per copy.

Strength of Materials

ALFRED P. POORMAN, Professor of Engineering Mechanics, Purdue University, whose membership in A.S.T.M. dates from 1908, has completed the fourth edition of his very widely used textbook on "Strength of Materials." Numerous additions and changes have been incorporated including material on aluminum, duralumin, and magnesium columns. Three articles on the derivation and use of the parabolic column formula for steel columns have been added, since at present it is one of the most widely used column formulas. The effect of combined beam and column action has been treated both in analysis and in design. Entirely new problems are used throughout the book.

Professor Poorman states that "Strength of materials is that branch of mechanics which treats of the forces acting upon elastic bodies and the resulting deformations. The elastic bodies that are considered are those which compose machines and structures used in engineering work." He then goes on to include in the 350 pages, material that covers in a clear and concise manner what a student of materials should readily absorb.

A companion book also in its fourth edition is "Applied Mechanics." Both volumes can be obtained from McGraw-Hill Book Co., Inc. "Strength of Materials" is priced at $3.00 and "Applied Mechanics" $2.75.

Chemistry of Coal Utilization—Two Volumes

THE NEW publication entitled "Chemistry of Coal Utilization" issued in two volumes by John Wiley & Sons, Inc., is an outstanding and monumental work. It should be of widespread interest and service to a great many technologists concerned with coal and its products, and is a reference book that will be a splendid addition to the files of any company or individual who wants authoritative information in this field. Prepared under the sponsorship of the Division of Chemistry and Chemical Technology of the National Research Council, the actual planning was left to a committee headed by H. H. Lowry, Director, Coal Research Laboratory, Carnegie Institute of Technology, Pittsburgh.

To prepare a comprehensive but critical review of the great amount of literature on the subject, cooperation of numerous authors was solicited and they prepared the some 38 topics covered. Since physical as well as chemical properties of coal are of great importance, there is considerable material devoted to this. Work was started in 1938 and completed early this year. The writer of each chapter, an authority in his field, not only evaluates his subject on the basis of published literature, but includes considerable new material, particularly in fields where additional knowledge would be most helpful.

A list of topics follows:

Volume I

Origin of Coal
Classification
Coal Petrography
Calorific Value
Hardness, Strength and Grindability
Plastic, Agglutinating, Agglomerating and Swelling Properties of Coals
Physical Properties
Chemical Constitution
  As Determined by Halogenation Reactions
  As Determined by Oxidation Reactions
  As Determined by Reduction Reactions
  As Determined by Hydrolytic Reactions
Forms of Sulfur in Coal
Occurrence of Nitrogen
Composition and Origin of the Mineral Matter
Fusion, Flow and Clinkering of Coal Ash: Survey of Chemical Background
Cleaning
Condition of Water
Changes During Storage
Action of Solvents
Vacuum Distillation
Industrial Coal Carbonization
Dependence of Yields of Products on Temperature and Rate of Heating
Pretreatment for Carbonization
Physical Properties and Reactivity of Coke

Volume II

Gas from Coal Carbonization
Removal of Sulfur Compounds from Coal Gas
Recovery of Ammonia, Cyanogen, Pyridine, and Other Nitrogenous Compounds from Industrial Gases
Light Oil from Coke-Oven Gas
Removal of Miscellaneous Constituents from Coal Gas
Utilization of Coal Gas
Chemical Nature of Coal Tar
Ammoniacal Liquor
Combustion in Fuel Beds
Combustion of Pulverized Coal
Direct Generation of Electricity from Coal and Gas (Fuel Cells)
Producers and Producer Gas
Water Gas
Hydrogenation of Coal and Tar
Synthesis of Hydrocarbons from Water Gas
Methanol Synthesis from Water Gas

Each chapter includes many references; some range up to 600. Each volume has a complete name Index (A.S.T.M., for example, has many references to its publications); there is a detailed subject Index, and an Index which lists alphabetically, by authors, titles of books cited.

The names of many A.S.T.M. members are included in the list of those who aided in the preparation of these volumes. They include Messrs. Fieldner, Gauger, Rhodes, Rose, Selvig, Shnidman, Hebley, and others.

The editor, Dr. H. H. Lowry, in his preface gives his opinion that a new edition of the book will never be necessary since it can be kept up to date with supplementary monographs.

Copies of the set of two volumes, comprising more than 2000 pages can be obtained from John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y., at a cost of $20. Every effort has been made to keep the price as low as possible, consistent with good workmanship. No royalties have been paid, nor individual chapter reprints struck off. Furthermore, contributions have helped to reduce the price of the volumes. Printed on excellent stock, with numerous illustrations and tables, page size 6 by 8½ in., this publication is an outstanding addition to the technical literature.

New Standards Review

THE BRITISH Standards Institution has issued the first of a series of reviews of its activities in a new bulletin entitled the *Standards Review*. This is to be issued periodically and sent to the members of the B.S.I.; nonmembers can obtain the publication at a subscription rate of seven shillings per year.

Lord Woolton, British Minister of Reconstruction, and President of the B.S.I. in a message in the first issue, refers to the Institution's standing of 40 years, and urges the producers, distributors and consumers to help

"promote and extend the policy of standardization in the articles and service with which they are concerned. If we are to maintain and improve our national standard of life, we must take every step to increase the efficiency of our production and output per unit of labor. As a nation we cannot enjoy a higher standard of life until we have produced the material means of providing it; standardization can make an important contribution to this end.

"The British Standards Institution is a good example of a democratic organization: no standards are issued until they have been agreed by the representatives of all the interests concerned—producers, consumers and technical and professional bodies. The same organizations which are responsible for the issue of British Standards keep them under constant review, so that revisions may be issued from time to time to conform to progress dictated by experience."

Indian Standards Institution

A COMMITTEE has been appointed by the Council of Engineers (India) to investigate the formation of an Indian Standards Institution. P. R. Agarwal who is directing preliminary investigations has been in touch with the Society for information on how ASTM functions, its committees, publications, etc.

NEW MEMBERS TO JULY 18, 1945

The following 117 members were elected from May 4 to July 18, 1945:

Chicago District

CORDAGE, INC., William J. Crehan, Chemical Engineer, 8106 S. Halsted St., Chicago 20, Ill.

REFINERY ENGINEERING CO., THE, T. M. Lumly, President, 600 S. Michigan Ave., Chicago 5, Ill.

UNIVERSAL OIL PRODUCTS CO., D. J. Bergman, 310 S. Michigan Ave., Chicago 4, Ill. [S]*

ADLER, HOWARD, Chief Chemist, Victor Chemical Works, Eleventh and Arnold Sts., Chicago Heights, Ill.

CANDLIN, J. E., JR., Assistant to Chief Engineer, Pullman-Standard Car Manufacturing Co., Engineering Dept., 10909 Cottage Grove Ave., Chicago 28, Ill.

HOOD, EDWARD CARLETON, Research Engineer, Buick Motor Division, General Motors Corp., Melrose Park, Ill. For mail: 1224 N. Cicero Ave., Chicago 51, Ill.

KNASIEWICZ, JOSEPH F., Engineer, Victor Adding Machine Co., Chicago, Ill. For Mail: 4335 N. Kimball Ave., Chicago 18, Ill.

PENROD, E. B., Research Engineer, Armour Research Foundation, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

STONE, H. C., Metallurgist, Belle City Malleable Iron Co., Racine, Wis.

SWANN, R. C., Director of Research, American Mineral Spirits Co., 230 N. Michigan Ave., Chicago 1, Ill.

Cleveland District

HARRIS, WILLIAM R., Chemical Engineer, Columbia Chemical Div., Pittsburgh Plate Glass Co., Barberton, Ohio. For mail: 180 Eighth St., N. W., Barberton, Ohio [J]†

JENKIN, WILLIAM C., Chief Chemist, Thompson Products, Inc., Cleveland, Ohio. For mail: 10418 Sandusky Ave., Cleveland 5, Ohio.

OLIN, R. R., Owner, R. R. Olin Laboratories, Box 372, Akron 9, Ohio.

PHILLEO, HENRY, X-ray Technician, Jack & Heintz, Inc., Plant No. 5, Cleveland 1, Ohio [J]

PROPPER, CLAYTON HARWOOD, Product Engineer, C. L. Gougler Machine Co., Kent, Ohio. For mail: 326 N. Willow St., Kent, Ohio.

TERRY, T. E., Partner, Wilbur Watson Associates, 4614 Prospect Ave., Cleveland 3, Ohio.

TOWNSEND, CHARLES D., Chief Project Engineer, The S. K. Wellman Co., 10510 Park Lane, Cleveland, Ohio.

Detroit District

CHANDLER, WALTER G., Product Engineer, Aircraft Hydraulic Supplies, Ltd., Windsor, Ont., Canada. For mail: 887 Victoria Ave., Windsor, Ont., Canada.

GAMBRILL, CHARLES M., Chief Analytical Chemist, Ethyl Corp., 1600 W. Eight Mile Rd., Detroit 20, Mich.

JOHNSON, EDWARD T., Bearings Engineer, Chrysler Corp., Detroit 31, Mich. For mail: 5861 Pontiac Trail, R. R. No. 2, Box 341, Walled Lake, Mich.

New York District

BAKER CASTOR OIL CO., THE, T. C. Patton, Manager of Technical Service, 35 Avenue A, Bayonne, N. J.

CONTINENTAL FELT CO., E. P. Travis, Manager, 880 Broadway, New York 3, N. Y.

DICTAPHONE CORP., Richard G. Rowe, Supervisor of Chemical Research, Bridgeport 5, Conn.

MARINE MANUFACTURING AND SUPPLY CO., Philip S. Dey, Works Manager, 30 New St., New Brunswick, N. J.

NATIONAL ADHESIVE DIVISION OF NATIONAL STARCH PRODUCTS, INC., F. C. Campins, Manager, Industrial Research Dept., 270 Madison Ave., New York 17, N. Y.

NATIONAL RUBBER MACHINERY CO., A. DeGhetto, Vice-President, Clifton, N. J.

BRANIN, FRANCIS S., Vice-President and General Manager, Middlesex Manufacturing Co., Inc., Middlesex, N. J. For mail: 211 Farragut Rd., North Plainfield, N. J.

COCKERAM, HERBERT S., Assistant Chief Chemist, Gillespie-Rogers-Pyatt Co., Inc., New York, N. Y. For mail: 39 Essex St., Jersey City 2, N. J.

CORDIANO, J. J., Engineer, Hardy Metallurgical Co., 420 Lexington Ave., New York 17, N. Y.

DAVIS, GORDON A., Supervisor of Physical Metallurgy, Sylvania Electric Products, Inc., Box 6, Bayside, L. I., N. Y.

FAITH, PHIL C., Chief Equipment Inspector, Fifth Avenue Coach Co., New York City Omnibus Corp., 605 W. 132d St., New York 27, N. Y.

GUTFARB, GEORGE, Director of Research, National Tile and Marble Corp., 529 W. Forty-sixth St., New York 19, N. Y.

HALL, CHARLES J., Materials Engineer, ARMA Corp., 254 Thirty-sixth St., Brooklyn 32, N. Y.

HEYMAN, MOSES D., Director of Research, Heyman Co., New York, N. Y. For mail: 38 Burton Ave., Woodmere, N. Y.

KEARNEY, JAMES A., Assistant Chief Metallurgist, Crucible Steel Co. of America, Harrison, N. J. For mail: Box 326, Newark 1, N. J.

KRUEGER, FORREST J., Engineering Manager, National Aniline Div., Allied Chemical and Dye Corp., 40 Rector St., New York 6, N. Y.

KUEBLER, WERNER R., Chief Chemist, Gillespie-Rogers-Pyatt Co., Inc., New York 7, N. Y. For mail: 39 Essex St., Jersey City 2, N. Y.

MACHT, MAURICE L., Technical Service, E. I. du Pont de Nemours and Co., Inc., Plastics Dept., Arlington, N. J.

MONTANARO, STEPHEN A., Test Engineer and Metallurgist, New York Testing Laboratories, Inc., New York, N. Y. For mail: 197-03 Forty-eighth Ave., Flushing, N. Y.

PASSAMANECK, EMANUEL, Head of Analytical and Control Lab., Reed & Carnrick, 155 Van Wagenen Ave., Jersey City 6, N. J.

SCHWARTZ, A. A., Director, American Analytical Laboratories, Inc., 326 W. Seventieth St., New York 23, N. Y.

SCHWEITZER, LOUIS, President, Peter J. Schweitzer, Inc., 69th Fl., Chrysler Bldg., New York 17, N. Y.

SHERWOOD, EDWIN M., Metallurgist, Sperry Gyroscope Co., Inc., Clinton Rd. and Stewart Ave., Garden City, L. I., N. Y.

SMITH, S. A., JR., Plant Manager, General Cable Corp., 26 Washington St., Perth Amboy, N. J.

VANDERVEER, FRANKLYN, Metallurgist, Works Lab., Sperry Gyroscope Co., Inc., Lake Success, L. I., N. Y. For mail: 3 Ash Dr., Great Neck, L. I., N. Y.

WHITE, IRA MORGAN, Chief Engineer, The Pelton Water Wheel Co., 2929 Nineteenth St., San Francisco 10, Calif.

ZIEGFELD, ROBERT LINDLEY, Assistant Secretary, Lead Industries Assn., 420 Lexington Ave., New York 17, N. Y. For mail: R. F. D. 5, Ridgefield, Conn.

Philadelphia District

HOUDRY PROCESS CORP. OF PENNSYLVANIA, Raymond C. Lassiat, Chief Engineer, Box 427, Marcus Hook, Pa.

ROYAL AND CO., THOMAS M., R. R. Wiggins, 5800 N. Seventh St., Philadelphia 20, Pa.

ANDERSEN, ARNOLD H., Laboratory Director, Individual Drinking Cup Co., Inc., Easton, Pa.

SCHWARTZ, JOSEPH L., President, TruTest Laboratories, Inc., 261 S. Third St., Philadelphia 6, Pa.

Pittsburgh District

PITTSBURGH CORNING CORP., Vic Sanders, Engineer, 632 Duquesne Way, Pittsburgh 22, Pa.

ALLEGHENY, COUNTY OF, BUREAU OF TESTS, DEPARTMENT OF WORKS, Pittsburgh 19, Pa.

KAYE, ALBERT L., Metallurgical Engineer, Carnegie-Illinois Steel Corp., 1465 Frick Annex Bldg., Pittsburgh 30, Pa.

SIGAL, J. L., Chemist, Pittsburgh Testing Laboratory, 1330 Locust St., Pittsburgh 19, Pa.

Southern California District

CENTURY AIRCRAFT CO., J. M. Henry, General Manager, 5601 W. Century Blvd., Inglewood, Calif.

DAY AND NIGHT MANUFACTURING CO., Edmund F. Lorman, Chief Research Engineer, Box 150, Monrovia, Calif.

GIDDINGS, RAY C., Engineer, Western Concrete and Equipment Co., Vernon, Calif. For mail: 706 Camulos St., Los Angeles 23, Calif.

Western New York-Ontario District

BUFFALO CARPENTER CONTAINER CO., INC., Vincent A. Giles, Secretary, 1200 Niagara St., Buffalo 13, N. Y.

DOMINION MAGNESIUM, LTD., L. V. Whiton, Sales Manager, Haley, Ont., Canada.

AVALLONE, B. W., President, Jamestown Finishing Products, Inc., 125 Blackstone Ave., Jamestown, N. Y.

CALHOUN, JOHN M., Research Chemist, Eastman Kodak Co., Department of Manufacturing Experiments, Kodak Park, Rochester 4, N. Y.

U. S. and Possessions

AYERS ENGINEERING, J. H., John W. Henley, Chief Engineer, 125 W. Twenty-first St., Indianapolis 2, Ind.

CARTER TRAVELER CO., R. J. Wheeler, Chief Metallurgist, Box 237, Gastonia, N. C.

CENTRAL OF GEORGIA RAILWAY CO., H. Hawthorn, Mechanical Engineer, Savannah, Ga.

EXCELSIOR MILLS, D. D. Quillian, Manager, Clemson, S. C.

HYTRON RADIO AND ELECTRONICS CORP., J. A. Bilhoefer, Research Chemist and Metallurgist, Kent and Warren Sts., Newburyport, Mass.

INGERSOLL STEEL AND DISC DIVISION, BORG-WARNER CORP., L. S. Gifford, Plant Engineer, 763 E. Vine St., Kalamazoo 21F, Mich.

LONG, JR., CO., CHAS. R., Otto J. Mileti, Vice-President, 1630 W. Hill St., Louisville 10, Ky.

MIDWEST RESEARCH INST., Miss Gladys Garland, Librarian, 4049 Pennsylvania, Kansas City 2, Mo.

MOORE CO., RUSSELL B., Mark B. Owen, Partner, 1456 N. Delaware St., Indianapolis 2, Ind.

MORRIS MACHINE WORKS, H. W. Jeffcock, Tool Engineer, Baldwinsville, N. Y.

SANTEE MILLS, INC., Gerner A. Olsen, Research Director, Box 478, Bamberg, S. C.

SCHAEFER VARNISH CO., A. E. Stauderman, Technical Director, Fifteenth and Magnolia, Louisville, Ky.

SEIDLITZ PAINT AND VARNISH CO., Otto Jensen, Vice-President, Eighteenth and Garfield Sts., Kansas City 10, Mo.

TITAN METAL MANUFACTURING CO., M. J. Mianulli, Supervisor of Customer Service, Bellefonte, Pa.

WATKINS CO., THE J. R., Allyn M. Ramsden, General Superintendent, Winona, Minn.

BAINBRIDGE, CITY OF, C. A. Miller, Jr., Mayor, Bainbridge, Ga.

BEACHAM, JAMES DOUTHIT, Beacham & LeGrand, Architects, Greenville, S. C. For mail: Church St., Beaufort, S. C.

CHILEAN NAVAL COMMISSION, 2128 Bancroft Pl., N. W., Washington 8, D. C.

CURREY, JOHN R., Supervisor, Fuel Test Lab., Air Technical Service Command, Procurement Div., Inspection Section, Fuel, Lube and Chemicals Branch, Laboratory Unit, U. S. Army Air Forces, Wright Field, Dayton, Ohio. For mail: 232 Harshman Homes, Dayton 3, Ohio.

EDWARDS, C. H., Chief Chemist, Seaboard Air Line Railway Co., Norfolk, Va. For mail: Box 661, Hamlet, N. C.

FAY, SAMUEL C., Engineer, The Eagle Picher Co., Cincinnati, Ohio. For mail: 7011 Fernbank Rd., Cincinnati 33, Ohio.

FINN, FRED N., Ensign, U.S.N.R., 265 Fifth St., Yuma, Ariz. [J]

FREI, OTTO C., President, Washington-Idaho Lime Products Co., Orofino, Idaho.

GARDINER, WINSTON A., Assistant Mechanical Engineer, I. F. Laucks, Inc., 911 Western Ave., Seattle 4, Wash.

GILLEY, FRED S., Manager, Top Dept., A. W. Hilliard and Son, 253 Summer St., Boston 10, Mass.

HAGELSTON, HERBERT F., Chemist, Motor Fuel Lab., Commonwealth of Massachusetts, 663 Beacon St., Boston 15, Mass.

HOLMGREN, WILLIAM C., Chemist, 2632 Bellevue Rd., Muskegon, Mich.

HOOGSTOEL, L. E., Technical Director, Behr-Manning Corp., Troy, N. Y.

INSTITUTE OF TEXTILE TECHNOLOGY, Lewis Larrick, Textile Technologist, Charlottesville, Va.

KING, ALBERT DUNNING, Associate, DeBell & Richardson, Box 240, Springfield, Mass.

KING, R. R., Technical Director, Interstate Cotton Oil Refining Co., 1201 E. Pecan St., Sherman, Tex.

KIRBY, HAROLD LOUIS, Engineering Inspector, Seaboard Air Line Railway Co., Norfolk, Va. For mail: 324 W. Twenty-seventh St., Norfolk 8, Va. [J]

MATLOCK, R. C., Chemical Engineer, Ken-Rad Division, General Electric Co., Owensboro, Ky. For mail: 2511 Frederica St., Owensboro, Ky.

MCMAIN, ALBERT THOMSON, Factory Manager and Chief Inspector, McGhee Time Service Aircraft Division, Consolidated Tool and Machinery Corp., Nashville, Tenn. For mail: 1107 Fatherland St., Nashville, Tenn.

MUHITCH, F. H., Foreman, Sylvania Electric Products, Inc., Box 270, Williamsport, Pa.

MULHOLLAND, ROYE ARTICE, Partner, Austin Engineering Co., 203 Riverside Dr., Austin 22, Tex.

NORTHERN REGIONAL RESEARCH LABORATORY, Peoria Sub-Branch, U. S. Department of Agriculture Library, Peoria 5, Ill.

PARSONS, R. C., Chief Inspector, Robert W. Hunt Co., 502 Ramsay-McCormick Bldg., Birmingham 8, Ala.

REINHART, FRANK W., Senior Chemist, Organic Plastics Section, National Bureau of Standards, Washington 25, D. C.

RUDGERS, ANTHONY J., Chief, Federal Specifications Div., Procurement Division, U. S. Treasury Dept., Seventh and D Sts., S. W., Washington 25, D. C. For mail: 304 S. Ivy St., Arlington, Va.

SHENK, ROBERT H., Administrative Engineer, J. A. Zurn Manufacturing Co., Erie, Pa. For mail: 1054 W. Sixth St., Erie, Pa.

SWIFT, GEORGE P., Consulting Engineer, 53 Galen St., Watertown 72, Mass.

THOMPSON, JOHN G., Metallurgist, National Bureau of Standards, Washington 25, D. C.

VIRGINIA, COMMONWEALTH OF, DIVISION OF THE BUDGET, SECTION OF INSTITUTIONAL ENGINEERING, The Capitol, Richmond, Va.

Other than U. S. Possessions

BRITISH TIMKEN, LTD., J. H. Evans, Metallurgist, Cheston Rd., Aston, Birmingham, England.

DENISON AND SON, LTD., SAMUEL, H. M. Denison, General Manager, Hunslet Foundry, Leeds 10, England.

ENFIELD ROLLING MILLS, LTD., Brimsdown, Enfield, Middlesex, England.

PETRÓLEOS MEXICANOS, DEPARTAMENTO DE LUBRICANTES, Ave Juárez No. 94, Despacho 408, Mexico, D. F., Mexico.

USINA QUEIROZ JUNIOR, LIMITADA, Marcos Carneiro de Mendonca, President, Esperança, E. F. C. B., Estado de Minas Gerais, Brazil.

ARNOT, PAUL, Superintendent of Development, Arabian American Oil Co., Shakran, Saudi Arabia.

GRANT, JAMES, Refinery Manager, United British Oilfields of Trinidad, Ltd., Port of Spain, Trinidad, B. W. I.

MCCAMMON, G. A., Division Chief Engineer, Creole Petroleum Corp., Apartado 172, Maracaibo, Venezuela.

SANITER, FRANK H., Director of Research, The United Steel Cos., Ltd., Central Research Dept., Stocksbridge, Nr. Sheffield, England.

TOONE, LEONARD ARTHUR, Refinery Manager, Anglo-Egyptian Oilfields, Ltd., Shell House, Box 228, Shana, Cherifein, Cairo, Egypt. For mail: Anglo-Egyptian Oilfields, Ltd., The Refinery, Suez, Egypt.

VAN WINSEN, A., Director of Development, Dominion Rubber Co., Ltd., 550 Papineau Ave., Montreal 25, P. Q., Canada.

* [S]—Denotes Sustaining Member.
† [J]—Denotes Junior Member.

Personals. . .

. . .News items concerning the activities of our members will be welcomed for inclusion in this column.

LOUIS McDONALD, formerly Chief Test Engineer, Garfield Division of the Houdaille-Hershey Corp., Decatur, Ill., has accepted an appointment to the Research Staff of the Department of Chemical Engineering, California Institute of Technology, Naval Ordnance Test Station, Inyokern, Calif.

CARL L. BARKER, formerly District Manager, Robert W. Hunt Co., Birmingham, Ala., is now Chief Inspector, Crane Enamelware Co., Chattanooga, Tenn.

RAYMOND B. STRINGFIELD is now Technical Director, Reeves Rubber, Inc., San Clemente, Calif. He was Staff Process Engineer, Consolidated Vultee Aircraft Corp., Vultee Field, Calif.

PAUL M. CHRISTENSEN has left the employ of Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn., to take a position with Clark Controller Co., Cleveland, Ohio.

LAWRENCE PEREZ, formerly Assistant Professor in Civil Engineering, Cooper Union, New York, N. Y., is now Professor, Civil Engineering Department, Pennsylvania State College, State College, Pa.

G. G. THOMAS has been appointed Engineer of Bridges with Atlantic Coast Line Railroad Co., Wilmington, N. C. He was formerly Engineer of Metal Structures with Atlantic Coast Line.

C. E. TUTTLE, who was Chairman and President, Rustless Iron and Steel Corp., Baltimore, Md., is now Management Consultant, The American Rolling Mill Co., Baltimore, Md.

L. W. RYAN is now connected with Interchemical Corp., Research Laboratories, New York, N. Y. He was with Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

GURDON M. BUTLER, JR., is now Associate Director of Research of the Allegheny Ludlum Steel Corp. He was formerly Chief Metallurgist.

J. D. DOHERTY, who was Research Engineer, Koppers Coal Division, Eastern Gas and Fuel Associates, Pittsburgh, Pa., is now with the Office of Synthetic Liquid Fuels, U. S. Bureau of Mines, Washington, D. C.

L. F. LOTTIER, for the past twelve years Assistant Metallurgist for the Peoples Gas Light and Coke Co., Chicago, Ill., has been named Metallurgist for The Accurate Steel Treating Co., Chicago, it has been announced by Walter G. Hamilton, President.

EDWARD R. FISH of The Hartford Steam Boiler Inspection and Insurance Co., past chairman of the Boiler Code Committee, was presented with a scroll to commemorate his election as an Honorary Member of the National Board of Boiler and Pressure Vessel Inspectors at a dinner given by the A.S.M.E. Boiler Code Committee at the Engineers' Club, New York, in May, as host to the National Board, H. B. OATLEY, Vice-President, The Superheater Co., New York, and Chairman of the Boiler Code Committee, which was host to the Inspectors, presided and spoke at the dinner.

O. S. DUFFENDACK, Director of Research, North American Philips Co., Inc., Dobbs Ferry, N. Y., has been appointed Vice-President and Director of Research and Engineering.

O. J. HORGER, formerly In Charge of Railway Engineering and Research, Timken Roller Bearing Co., Canton, Ohio, is now the Chief Engineer of the Railway Division. He has a 20-year record with Timken in this field.

W. R. TOEPLITZ, Secretary of Committee B-9 on Metal Powders and Metal Powder Products, has been named Vice-President in Charge of Engineering Research, Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. He was previously Production Manager.

RAYMOND E. BIRCH, formerly Research Engineer, is now Director of Research, Harbison-Walker Refractories Co., Pittsburgh, Pa., succeeding F. A. Harvey, deceased.

Several A.S.T.M. members are serving on the special committee of the American Association of Textile Chemists and Colorists organized to develop a test to determine the flammability of consumer textiles at the request of the National Retail Dry Goods Association, as follows: FREDERIC BONNET, Director, Standards Department, American Viscose Corp.; CHARLES W. DORN, Director of Research and Testing Laboratories, J. C. Penney Co.; CHARLES L. SIMON, Secretary-Treasurer, Industrial By-Product and Research Co.; and H. E. WILDE, Merck and Co., Inc.

Two A.S.T.M. members were elected officers of the American Oil Chemists' Society recently: S. R. KING, Technical Director, Interstate Cotton Oil Refining Co., Sherman, Texas, *President;* and S. O. SORENSEN, Chemist, Archer-Daniels-Midland Co., Minneapolis, Minn., *Vice-President.*

CHARLES E. SKINNER, founder of the Westinghouse Research Laboratories from which he retired several years ago during the War Period has put in intensive service as a civilian consultant, Army Signal Corps. He was honored recently on relinquishing this work by his former Westinghouse associates at a dinner marking his eightieth birthday.

Several A.S.T.M. members have been elected officers of the American Concrete Institute: *President:* DOUGLAS E. PARSONS, Chief, Masonry Construction Section, National Bureau of Standards, Washington D. C.; *Vice-Presidents:* HARRISON F. GONNERMAN, Manager, Research Laboratory, Portland Cement Association, Chicago, Ill., and STANTON WALKER, Director of Engineering, National Sand and Gravel Association, Washington, D. C.; *Directors of the First, Second, and Third Districts:* respectively, Messrs. HENRY L. KENNEDY, Manager, Cement Division, Dewey & Almy Chemical Co., Cambridge, Mass., MYRON A. SWAYZE, Director of Research, Lone Star Cement Corp., Hudson, N. Y., and ALEXANDER FOSTER, JR., Vice-President, Warner Co., Philadelphia, Pa.

OWEN W. ELLIS, Director, Department of Engineering and Metallurgy, Ontario Research Foundation, Toronto, Canada, has been elected chairman of the Metallurgy Division of the Canadian Institute of Mining and Metallurgy. The Institute decided that formation of a separate division was necessary in view of the growing scope and importance of metallurgy in Canada's industrial development.

PHILIP SPORN, for some years Vice-President and Chief Engineer, American Gas and Electric Service Co., New York, N. Y., has been elected to the position of Executive Vice-President.

J. I. YELLOTT has resigned as Director of Mechanical Engineering at Illinois Institute of Technology to become Director of Research for the Locomotive Development Committee of Bituminous Coal Research. He took up his new duties on May 1 with headquarters in Baltimore.

E. F. HESS, Metallurgical Engineer, Ohio Injector Co., Wadsworth, Ohio, has severed his connection with that company after many years of service.

H. A. SCHWARTZ, Manager of Research, National Malleable and Steel Castings Co., Cleveland Ohio, extremely active in many phases of A.S.T.M. work, has prepared the 1945 Foundation Lecture of the American Foundrymen's Association on the subject "Solidification of Metals." This 78-page treatise, with extensive bibliographical references and profusely illustrated, has been sent to all A.F.A. members. These lectures have produced authoritative discussions on a number of foundry problems. The 1943 lecturer was J. W. Bolton, The Lunkenheimer Co., and in 1944, H. W. Gillett, Battelle Memorial Institute was honored.

MORRIS L. LEEDS, Chairman of the Board of Leeds & Northrup Co., Philadelphia, Pa., who in the early years of the company represented the membership in A.S.T.M., recently received from the Philadelphia Rotary Club its first award for notable contributions to the principles of Rotary in the field of business, education, industrial management, and world citizenship. Mr. Leeds has taken a leading part in educational work in Philadelphia being President of the Board of Education.

E. P. FAGER who was Chemical Engineer, Dearborn Chemical Co., Chicago, Ill., is now Assistant Vice-President.

W. F. KASPER is now President of Fairmont Railway Motors, Inc., Fairmont, Minn. He was formerly Vice-President of the company.

ARTHUR D. KEAN, formerly with Sutton-Horsley Co., Ltd., Toronto, Canada, is now with Duplate Tool and Die Co., Toronto, Canada, as Metallurgist.

RAYMOND A. ENGEL is now Vice-President of Production and Engineering of the Fisher Governor Co., Marshalltown, Ohio.

R. A. SHIVE is connected with the Pigment Department, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., as Director of Technical Service.

MILFORD H. CORBIN, who was Director of Research and Manager of Industrial Sales, is now Director of Sales and Vice-President of Standard Varnish Works, Staten Island, N. Y.

EDWIN A. GLENN, JR., formerly Testing Engineer, American Car and Foundry Co., Berwick, Pa., is now Senior Metallurgist, Mack Manufacturing Corp., Plainfield, N. J.

T. I. CURTIN, JR., who was Vice-President, is now President and General Manager of Waltham Foundry Co., Waltham, Mass.

WALTER W. EDENS is connected with Ampco Metal, Inc., Milwaukee, Wis., as Technical Director. He was formerly Chief Metallurgist.

D. E. JACK, formerly General Manager, Duriron Co., Inc., Dayton, Ohio, is now Vice-President in Charge of Engineering and Sales.

ROY M. GREEN, who was Professor of Civil Engineering, and Chairman of the Civil Engineering Department, University of Nebraska, Lincoln, Nebr., is now Dean of Engineering.

FRED L. PLUMMER, formerly Chief Research Engineer, Hammond Iron Works, Warren, Pa., is now Director of Engineering.

CHARLES F. DUCHACEK is now Chemical Engineer, Technical Service Laboratory, Socony-Vacuum Oil Co., Brooklyn, N. Y. He was Chemical Engineer, Arabol Manufacturing Co., Brooklyn, N. Y.

IRVING A. OEHLER, who was Chief Metallurgist, is now Director of Metallurgy and Research, The American Welding and Manufacturing Co., Warren, Ohio.

HERBERT A. BEDWORTH, who was Manager, Development Engineering, The American Brass Co., Waterbury, Conn., is now Manager of Sales Engineering, The Bristol Brass Corp., Bristol, Conn.

GEORGE H. RAITT, for a number of years Vice-President and General Manager of The Steel Tank and Pipe Co. of California, Berkeley, Calif., which company has been affiliated with A.S.T.M. for some 20 years, has been elected President of the company. Mr. Raitt serves on A.S.T.M. Committee A-1 on Steel and is a member of the Northern California District Committee.

JOHN P. MAGOS, formerly Directing Engineer, is now Director of Research, Crane Co., Chicago, Ill.

L. EARLE WELCH is now Director, Plastic Division, Industrial Hard Chromium Co., Newark, N. J. He was Research Engineer, Bakelite Corp., Bloomfield, N. J.

ARTHUR L. SMITH, who was Research Director, North Star Woolen Mill Co., Minneapolis, Minn., is now Research Associate, Milton Harris Associates, Washington, D. C.

JOHN A. MUNYAK is now Chief Engineer, Polarized Products Corp., New York, N. Y. He was formerly Research Leader, Marco Chemical Co., Sewaren, N. J.

VINCENT F. LEWIS, who was Mechanical Enginner, Development Division, Adel Precision Products Corp., Burbank, Calif., is now Chief Engineer, AERO-MAT Machine Products, Hollywood, Calif.

GEORGE HENNING, JR., formerly Treasurer, is now President of the Belmont Smelting and Refining Works, Brooklyn, N. Y.

CHARLES L. FOREMAN, who is now Metallurgist, Crucible Steel Co. of America, Detroit, Mich., was with Buick Motor Co., Flint, Mich., as Metallurgist.

W. H. GRAVES, who has been active in A.S.T.M. work for a number of years and is a former member of the Executive Committee, has been appointed Executive Engineer of his company—Packard Motor Car Co., Detroit, Mich. He served the company for some time as Chief Metallurgist.

C. H. MAHONEY, formerly Chief Metallurgist, Basic Magnesium Incorporated, Henderson, Nevada, is now Vice-President in Charge of Metallurgical Control and Development, Howard Foundry Co., Chicago, Ill.

SILVIO PELLERANO is now Technical Supervisor, Richard Alan Button Co., Brooklyn, N. Y. He was Research Engineer, Kaydon Engineering Corp., Muskegon, Mich.

FRANK P. RHAME who was First Vice-President and General Manager, The Lunkenheimer Co., Cincinnati, Ohio, is now President of the company.

S. B. TUWINER, formerly Research Engineer, Revere Copper and Brass Inc., Rome, N. Y., is now Assistant to Director of Research, Phelps Dodge Corp., Maspeth, New York, N. Y.

RODERICK B. YOUNG, Assistant Chief Testing Engineer, Hydro-Electric Power Commission of Ontario, Canada, has been appointed Assistant Director of Research. Mr. Young, Past-President of the American Concrete Institute, participates in the work of several A.S.T.M. committees.

FREDERIC J. ROBBINS, who was Metallurgical Engineer, Plomb Tool Co., Los Angeles, Calif., is now Vice-President.

EMORY A. RICHARDS is now Chief Chemist, Airedale Worsted Mills, Inc., Woonsocket, R. I. He was in Technical Sales, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

VICTOR R. WILLOUGHBY, Vice-President in Charge of Engineering, American Car and Foundry Co., is retiring from active service after an affiliation of almost 50 years, and is being succeeded by E. D. Campbell. Mr. Willoughby has, for a great many years, been affiliated with the Society and has participated in the work of Committee A-1 on Steel, particularly the activities involving structural steel for buildings, cars, etc., and the work on steel sheets.

ARTHUR SCHRODER, widely known to many A.S.T.M. members because of his activities in the scientific apparatus field, has been appointed to the position of Executive Director of the American Institute of Chemists. A Fellow of the Institute, he recently has been evaluating chemical patents seized from the Axis powers in the office of Alien Property Custodian. His interests have involved primarily the two fields of petroleum products and the laboratory apparatus industry. Although affiliated with other groups, he has been particularly active in the work of the American Chemical Society, was Secretary of the A.C.S. Pittsburgh section for many years, and has been Managing Editor of the Chicago Section's *Chemical Bulletin*. Beginning in August, he will be located at the A.I.C. offices, 60 E. 42nd St., New York 17, N. Y.

W. O. McMAHON, who has established a Foundry Consultation Service in Birmingham, is retaining his connection with the Sloss-Sheffield Steel and Iron Co.

T. H. ROGERS, Associate Director of Research, Standard Oil Co. (Indiana), Whiting, Ind., very active in the work of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, received a certificate of merit from the Office of Scientific Research and Development for his work with other company men involving flame thrower research. During the work there was a serious explosion which resulted in the death of four research men at Whiting who received their certificates posthumously. Dr. Rogers, who sustained serious injuries at the same time, is recovering from the accident.

Two A.S.T.M. members have been selected for office in the American Society for Metals as follows: *Vice-President:* A. L. BOEGEHOLD, Head of the Metallurgy Department, Research Laboratories Division, General Motors Corp., Detroit, Mich.; and *Treasurer:* H. K. WORK, Manager of Research and Development, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

A. KENNETH GRAHAM, who is now Executive Secretary of the American Electroplaters' Society, with offices at 473 York Road, Jenkintown, Pa., is also serving as editor of the society's *Monthly Review*. Associated with Dr. Graham as Assistant Editor is GUSTAF SODERBERG, very active in A.S.T.M. work and affiliated with the firm of Graham, Crowley, and Associates, Inc.

The Coal Trade Association of Indiana has opened its laboratory to make analysis and tests, for its members, of coal produced in the state. HENRY O. ERB is Coal Preparation Engineer and Director of the laboratory.

GEORGE H. SLAGLE, formerly Manager of the Beryllium Div. of American Mining and Research Co., has taken over control of this division and it is now called the Slagle Beryllium Co. with Mr. Slagle as President. The address of the organization continues as before, Eagle and Lawrence Rds., Upper Darby, Pa.

In Europe on FEA work:

Among the some 200 leading American technologists who have been studying developments in Germany, some of them even before V-E day, are a number of members of the Society and committee people. This list, as released by the Foreign Economic Administration, is confined to the nongovernment civilian personnel. It is known that a number of people active in A.S.T.M., affiliated with government agencies, have also been abroad on related work. A.S.T.M. members include GEORGE BEISER, Bell Aircraft Corp.; MYRON SWAYZE, Lone Star Cement Corp.; JOHN R. TOWNSEND, Bell Telephone Laboratories, Inc.; FRED W. GOTTSCHALK, American Lumber and Treating Co.; JACOB H. TIGELAAR, Haskelite Manufacturing Co.; ERNST F. VOSS, Humble Oil and Refining Co.; E. L. BALDESCHWEILER, Standard Oil Development Co.; VICTOR CONQUEST, Armour and Co.; FRED L. WOLF, Ajax Metal Co.; EARNSHAW COOK, American Brake Shoe Co.; JAMES T. MACKENZIE, American Cast Iron Pipe Co.; ROBERT T. WOOD, American Magnesium Corp. of Cleveland; STUART M. PHELPS, American Refractories Institute; ALBERT J. PHILLIPS, American Smelting and Refining Co.; ROBERT F. MEHL, Carnegie Institute of Technology; RUDOLPH A. SCHATZEL, General Cable Corp.; BENJAMIN S. GARVEY, B. F. Goodrich Co.; ARTHUR H. NELLEN, Lee Tire & Rubber Co.; ROBERT B. BARNES, American Cyanamid Co.; and HAROLD J. ROSE, Bituminous Coal Research, Inc.

LAUCHLIN M. CURRIE, National Carbon Co., Inc., has been elected Vice-President in Charge of Research, this action having been taken at a meeting of the Board of Directors on July 24. Dr. Currie, in addition to serving on the Cleveland District Committee, has been very active in other phases of A.S.T.M. work, including the work of Committee D-20 on Plastics and particularly as a member of Committee E-6 on Papers and Publications, where his broad knowledge in the chemical field has been extremely helpful.

NECROLOGY

(Dates of death are given when available.)

ALBERT B. DORAN, Consulting Engineer, A. B. Doran Engineering Co., Los Angeles, Calif. Member since 1941. (Oct. 16, 1944.)

R. L. HARDING, Wilbur Watson Associates, Cleveland, Ohio. Mr. Harding who became a member just this year passed away on April 24.

CHARLES HARDY, President, Hardy Metallurgical Co., New York. Member since 1943. Mr. Hardy, who died after a short illness, was active in the work of Committee B-9 on Metal Powders and Metal Powder Products. A pioneering authority on powder metallurgy, he had written many papers and was a contributor to the Symposium on Powder Metallurgy published by A.S.T.M. in 1944. (June 8.)

E. W. ENGLE, Metallurgist, Carboloy Co., Inc., Detroit, Mich. Mr. Engle, who represented his company in the Society membership, served on Committee B-9 on Metal Powders and Metal Powder Products. He was chairman of Section III on Cemented Carbides of Subcommittee III on Metal Powder Products. (April 26.)

L. E. LUMPKIN of the Hermitage Gravel Co. and the Arkansas Gravel Co., Little Rock, Ark. Member since 1935. (January 11.)

J. W. REIFSYNDER, Chief Test Engineer, Bureau of Tests, Department of Works, Allegheny County, Pittsburgh, Pa. Member since 1921. (May 17.)

GEORGE H. TRIECE, Materials Engineer, Maryland State Roads Commission, Baltimore, Md. Member since 1938. Mr. Triece held membership on Committee C-9 on Concrete and Concrete Aggregates and Subcommittee IX on Specifications and Methods of Tests of Aggregates and had been a member of Committee D-4 on Road and Paving Materials since 1938, serving on several of its subcommittees.

V. F. HAMMEL, very active in A.S.T.M. technical committee work for many years, particularly on Committee A-5 on Corrosion of Iron and Steel, when he was affiliated with the utilities field, and more recently on Committee D-9 on Electrical Insulating Materials where he served as chairman of the Section on Glass Insulators, representing his company, the Armstrong Cork Co., died on June 15. He had also served on certain committees functioning under A.S.A. procedure.

Charles Hollister Davis

1886–1945

THE death on May 22 of C. H. Davis, after a brief illness, is a grievous loss to the non-ferrous industry and to society at large. After graduation from Yale College in the class of 1909, Mr. Davis took time to look about the West before receiving his M.A. in geology at Leland Stanford in 1912. In the autumn of that year, he entered the employ of The American Brass Co., Waterbury, Conn. There on the staff of the late W. H. Bassett, he began the work that he pursued with ever-broadening scope for the rest of his life. The brass industry in Waterbury was old, but technical laboratories in connection

with them were only in the second decade of their existence and presented a field in which Mr. Davis' talents found wide range. During the years that followed, he exerted a profound and indelible influence on the growing technology of non-ferrous alloys. On July 1, 1938, Mr. Davis was appointed Assistant Technical Manager of The American Brass Co., which position he held until the time of his death.

Mr. Davis was a scholar and always maintained a scholarly approach to his work. The vast amount of precise, original data collected under his direction stands as authoritative measures of the properties of alloys and as source material for his successors. Examples of his work have appeared in eleven papers presented before the A.I.M.E. and A.S.T.M., in data for the Metals Handbook and a number of publications in current journals. The quartz Hilger spectrograph, installed under his direction in 1914, was the first in this country to be used for metallurgical research and routine qualitative analysis of alloys and his paper on spectrum analysis (A.I.M.E., 1923) represented pioneer work.

In A.S.T.M., the paper "Physical Properties and Methods of Test for Some Sheet Non-Ferrous Metals" by J. R. Townsend, W. A. Straw, and C. H. Davis, won the Charles B. Dudley award in 1930.

Mr. Davis was a member of the A.I.M.E. and A.S.T.M., and took a particular interest in the work of the latter. His notable A.S.T.M. committee work included particularly Committee B-5 on Copper and Copper Alloys, Cast and Wrought, of which he had been Secretary from 1937 to 1944, and Committee E-4 on Metallography where he served as Chairman from 1930 to 1936. He also represented his company on many other committees.

Besides Mrs. Davis, he leaves a son, Capt. Donald H. Davis, and two daughters, Mrs. J. Rutledge Clark, Baltimore, Md., and Mrs. Gordon Tapley, Dayton, Ohio. Mr. Davis had long made his home in Cheshire, Conn., and was always found doing more than his share of the community work that has to be done by someone. Quietly and without ostentation, he did a vast amount of work conscientiously and well.

THOMAS ARCHIBALD WRIGHT

1887–1945

In the sudden death on May 25 of T. A. Wright, the Society loses a long-time member who contributed greatly to the advancement of its technical work along many lines, particularly, however, in the field of non-ferrous metals and chemical analysis, in both of which fields he was an outstanding authority. While not in the best of health for some time, Mr. Wright nevertheless had been continuing actively in his work as Technical Director and President of Lucius Pitkin, Inc., Metallurgical Chemists and Engineers, and his sudden death while at the railroad station at Plainfield was a shock to his many friends and associates in many lines of activity. A member of the Society since 1919, he had been active for many years in Committee B-2 on Non-Ferrous Metals and Alloys; Committee B-6 on Die-Cast Metals and Alloys; Committee B-7 on Light Metals and Alloys, Cast and Wrought; Committee E-4 on Metallography; and extremely active in Committee E-2 on Spectrographic Analysis and Committee E-3 on Chemical Analysis of Metals. He had been an officer of several of these committees and served as chairman of numerous subcommittees. He was Vice-Chairman of Committee E-2.

While his work on the technical committees of the Society was outstanding, he also contributed discussions and reports published in the Society's *Proceedings* and elsewhere and took a very active role in interesting individuals and companies in the work of the Society resulting in many new members.

Born in New York City, most of his industrial life was spent in the East, first with the DeLamar Copper Works and beginning in 1908 with Lucius Pitkin, Inc. For a period he was Chief Assayer at U. S. Lead Refinery. Active in numerous societies, particularly the American Institute of Mining and Metallurgical Engineers and the American Electro-Chemical Society, he was Past President of the Association of Consulting Chemists and Chemical Engineers. Among his hobbies was student guidance. Surviving are three children, two sons and a daughter, and Mrs. Wright. To them and to his wide circle of friends, the Society extends its sympathy and records its appreciation for his long-time and extensive services in its behalf.

Catalogs and Literature Received

Engineering Laboratories, Inc., Tulsa, Okla. A 16-page booklet entitled "The Story of the Penetron," describes in detail this instrument for measuring density, thickness, and other characteristics of materials by reflected gamma rays, giving principle of operation, calibration, time required for making measurements, description of individual parts, etc. Illustrated.

The Emil Greiner Co., 161 Sixth Ave., New York, N. Y. A leaflet describing and illustrating "Waltham Timers." Fifteen different types are listed and shown.

Randall and Sons, 2512 Etna St., Berkeley, Calif. A one-page leaflet describing the new Type C, Bearing Corrosion Test Strip and its use for measuring the "existent corrosivity" of new and used engine oils.

Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Catalog E-53, "Apparatus for D-C Resistance Measurements." Extensively revised to embody an expanded discussion of equipment and listing of specifications, this publication not only presents d-c resistance bridges, but the standards, galvanometers, accessories, etc., usually chosen for use with them. Instruments for a wide variety of applications will be found, each one listed and completely described. 36 pages, illustrated.

All American Tool and Manufacturing Co., 1014 Fullerton Ave., Chicago, Ill. Bulletin 425 titled "Post War Competition Demands Rigid Product Testing." Four-page leaflet describing and illustrating Models 25 HA and 25 H Vibration Fatigue Testing Machines.

Tabor Instrument Corp., North Tonawanda, N. Y. Bulletin No. 4506, a six-page folder describing the Taber V-5 Stiffness Gauge, giving its uses and application, and also stiffness definitions, specifications, and prices. Very well illustrated.

A.S.T.M. Standards in St. Louis and Garden City Building Codes

Many of the larger municipalities throughout this country embody A.S.T.M. test methods and specifications in their building codes, usually by reference to specific standards. Among the communities which have carried out work on their building codes within the past year have been the City of St. Louis, Mo., among the ten leading cities of the United States, and the village of Garden City in New York. Many of the Society's standards are referred to in the St. Louis code and quite a few in the Garden City document. The standards cover a wide range of materials in the ferrous field where the specifications for steel are particularly pertinent, and also the non-metallic construction materials such as cement, concrete, lime, masonry units, brick, tile, etc.

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